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NOTES

FROM THE

ROYAL BOTANIC GARDEN, EDINBURGH.

VOL. III.

Including Numbers XI.–XV.

1903–1908.

GLASGOW:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE
By JAMES HEDDERWICK & SONS LTD.,
AT "THE CITIZEN" PRESS, ST. VINCENT PLACE.

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Dates of the several Numbers of this Volume.

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Parts XII.-XIII., pp. 17-208 for November, 1904.
Part XIV., pp. 209-290 for February, 1905.
Part XV., pp. i-xiv, and 291-374 for March, 1908.

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Corrections and Additions.

Page 17, line 19, for Macnab read McNab.
,, 17, ,, 20, ,, Macnab ,, McNab.
,, 18, ,, 18, ,, Macnab ,, McNab.
,, 18, ,, 23, ,, Macnab ,, McNab.
,, 18, ,, 25, ,, Macnab ,, McNab.

,, 19. The Testament Dative and Inventory of the goods and gear of John Williamson in the Commissariot Record of Edinburgh of 28th February, 1781, states that he left one thousand pounds Scots (£83 6s. 8d. sterling) in Stock of the Bank of Scotland, his widow, Margaret Ridley, being sole executor.[1]

,, 20. From Kerr's Life of Wm. Smellie, Printer (2 vols., 8vo., Edin., 1811), page 243 of the second volume, I transcribe the following :—

The ensuing Proposals for publishing a *Flora Edinburgensis* by MALCOLM McCOIG, Gardener to the Royal Botanic Garden of Edinburgh, was written by Mr. SMELLIE, at the desire of the author ; who, though an excellent gardener, and intimately versant in all the plants of the garden he had charge of, and a good memorial botanist, had not the advantage of a liberal education.

Proposals for publishing | FLORA EDINBURGENSIS | OR | A Systematic Arrangement and Description of all the Plants, those of the Cryptogamia Class excepted, which grow wild within fourteen miles round Edinburgh | . *To which will be added,* | Complete Catalogues of the Plants which are found on each of the islands in the Firth of Forth. | By MALCOLM McCOIG, | Gardener to the Royal Botanic | Garden, Edinburgh.

Plan of the Work | At the beginning of every class, the several Orders and Genera will be enumerated, together with the short characters which distinguish one genus from another, after the manner of Linnæus. | Under each Genus, the several species, with their trivial names and specific differences, will be comprehended. References will likewise be made to those authors who have given figures of the different species. To every species, the English name, its duration, time of flowering, its native soil, the particular places in which it is found, and a short English description will be subjoined.

Conditions | The Work will be contained in one volume, 8vo., price Five Shillings in boards, to be paid on delivery of the Book.

2. It will be put to press as soon as a competent number of subscriptions are received."

I am indebted to Mr. A. P. Stevenson of Dundee, who kindly directed my attention to this prospectus. The book was not published. The author, as we have seen, died after a short term of office.

[1] I am indebted to the Rev. Henry Paton, M.A., for searching the records and giving me the transcript from which this and other matter given below has been obtained.

The Testament Dative and Inventory of the goods and gear of Malcolm McCoig is in the Commissariot Record of Edinburgh of 25th March, 1789. His widow, Eleonora Whitehead, was sole executor. The effects were "valued by Ann Gardner, auctioneer in Edinburgh, conform to her signed estimation," which shows that women practised as auctioneers at this date. Amongst the items in the inventory are 159 "copies of the History and Progress of Botany"[1]; 120 "of the Genera Plantarum"[2]; 109 "of the Index Herbarum Medicinalium"[3]; 79 "of the Catalogus Arborum et Fruticum"[4]; 5 "of the Termini Botanici"[5]; 12 "of Sud Gerardi"[6]; 2 "of the Plantarum Officinarum"[7]. These publications were all of the nature of class-books—none of any great bulk. One cannot believe that McCoig had accumulated the publications in the numbers mentioned for his own use, and it seems reasonable to suggest that they indicate a custom of the time—that the Head Gardener acquired them for sale to students at a profit, or they were given to him for sale as one of his perquisites; on the other hand, it may be that the auctioneer, finding them in the gardener's house, included them in the inventory, although they were there only for distribution to students.

Page 49, line 30, for could read would.

„ 55, „ 7, Alexander Don, father of George Don, removed from Beechhall, Menmuir, in 1772 or 1773 to Little Causeway, Forfar.—*Miss Jane Taylor Ewen, Mill Bank, Forfar, in letter, 23rd February*, 1905.

I do not know what book or pamphlet is here referred to.

"Genera Plantarum ex editione duodecima Systematis Naturæ illustrissimi Carolina Linne. In usus Academicos. Edinburgi: Typis Academicis, MDCCLXXI," pp. 88. This is the first edition of the pamphlet brought out by Dr. Hope—there were subsequent editions—for the use of his students. His name is not on the title page.

[3] Probably "Tirocinum botanicum Edinburgense conscriptum a Carolo Alston. Edinburgi: Typis W. Sands, A. Murray, and J. Cochran, veneunt autem apud G. Hamilton and J. Balfour, MDCCLIII," of which Part III. of 120 pages is entitled "Index plantarum medicinalium præcipue quæ studiosis demonstrantur."

[4] "Catalogus Arborum et Fruticum in Horto Edinensi crescentium anno 1778: Edinburgi apud Balfour et Smellie, MDCCLXXVIII," pp. 1-20. This is the earliest edition which I have seen of this catalogue by Dr. Hope, whose name does not appear.

[5] "Termini Botanici in usum juventutis Academiæ Edinensis. Accedunt Index Rerumque Series. Edinburgi: apud Balfour, Auld, et Smellie, Academiæ Typographos, MDCCLXX," pp. i.-vi.; 7-40. The first edition (I have later ones) of another pamphlet prepared for his students by Dr. Hope, but without his name on title page.

[6] I am unable to suggest an interpretation of this. Had the words been "Cat. Gerardi" they might have referred to John Gerardi's "Catalogus Arborum, fruticum ac plantarum tam indigenarum quam exoticarum in horto *Gerardi* nascentium" published in London in 1556, and we should have had an interesting indication of the scholastic use of Gerarde's Catalogue at the end of the 17th century. But Mr. Paton tells me the writing can be interpreted only as 'Sud' or 'Lud.' Possibly, as he suggests, there is a miswriting and the word should be 'Cat.'

[7] Probably "Index Plantarum Officinarum," pp. 66, which formed the third part of "Index Plantarum præcipue officinalium quae in Horto Medico Edinburgensi a Carolo Alston M. et B. P. Medicinæ studiosis demonstrantur. Edinburgi: apud W. Sands, A. Brymer, A. Murray, and J. Cochran, MDCCCXL." This book was the precursor of the "Tirocinum" of which it may be regarded as the first edition. This third part with separate pagination expanded from 66 pages in 1740 to 120 in 1753. The number of copies of this old edition remaining over in 1789 would naturally be small.

Page 67, line 29, for 1806 read 1807.

,, 67, ,, 31, ,, 1807 ,, 1808.

,, 71. Dr. Neill, in his essay "On Scottish Gardens and Orchards," which, although undated, we know (see pages 100 and 177 of the essay) to have been written in 1812, gives another description of Don's garden. It is on the same lines as those already transcribed on pages 71 and 73 of this volume, but we learn this new fact—"there is a small greenhouse, well stocked, however, containing nearly 1000 different species." The unkempt condition of the Garden seems to have impressed the writer particularly, and he depicts it in these words—"If anyone expect to find at Forfar an elegant botanical arrangement, kept in trim order, with nice gravelled walks, he will be quite disappointed. To neatness the Garden has no pretensions; on the contrary, during the summer months, it would often require a botanical eye to discern the humble rarities of Flora, among the rank attendant weeds." The picture tells of a chaotic condition worse than one would gather from Dr. Neill's earlier descriptions (see page 72 of this volume), and that mistakes in the recognition of particular plants should happen is only what might be expected (see page 142 of this volume). I may add here that Miss Jane Taylor Ewen of Mill Bank, Forfar, has been so kind as to inform me that "Don's Garden at Dovehill is now known as Ward-bank," and that "Laird's Factory and Mr. Laird's house stand on the site of Don's Garden, with grounds laid out all round."

,, 93, at end of footnote insert I.B.B.

NOTES

FROM THE

ROYAL BOTANIC GARDEN,

EDINBURGH.

JANUARY 1903.

CONTENTS.

Page.

List of Seeds collected in the Royal Botanic Garden, Edinburgh, during the Year 1902. - - - - - 1

GLASGOW

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Part XV
Completion of
volume III
+
Index to volume
to be
published.

Received
6/16/09

XV

vernalis, *Linn.*

Ægopodium
Podagraria, *Linn.*

glutinosa, *Medic.*
— var. rubrinervia, *Hort.*
japonica, *Sieb.* et *Zucc.*
serrulata, *Willd.*

[Notes, R.B.G., Edin., No. XI., 1903.]

List of Seeds Collected in the Royal Botanic Garden, Edinburgh, during the Year 1902.

The following is a list of plants cultivated in the Royal Botanic Garden, Edinburgh, from which ripened seeds have been collected during the year 1902. The quantity of seed obtained from some of the species is of limited amount. The seeds are available for exchange, but they are not for sale :—

PLANTS IN THE OPEN.

Acæna
- Novæ-Zelandiæ, *T. Kirk.*
- Sanguisorbæ, *Vahl.*

Acer
- opulifolium, *Vill.*, var. obtusatum.

Aconitum
- Napellus, *Linn.*
- pyrenaicum, *Hort.*

Actæa
- spicata, *Linn.*
- — var. rubra.

Adenophora
- stylosa, *Fisch.*

Adonis
- vernalis, *Linn.*

Ægopodium
- Podagraria, *Linn.*

Æthionema
- saxatile, *R. Br.*

Æthusa
- Cynapium, *Linn.*

Allium
- carinatum, *Linn.*
- fistulosum, *Linn.*
- margaritaceum, *Sibth.* et *Sm.*
- Moly, *Linn.*
- neapolitanum, *Cyr.*
- odorum, *Linn.*
- oreophilum, *C. A. Mey.*
- sativum, *Linn.*
- Schœnoprasum, *Linn.*
- — var. sibiricum.
- vineale, *Linn.*

Alnus
- cordifolia, *Tenore.*
- glutinosa, *Medic.*
- — var. rubrinervia, *Hort.*
- japonica, *Sieb.* et *Zucc.*
- serrulata, *Willd.*

Alstroemeria
aurantiaca, *Don.*

Alyssum
creticum, *Linn.*
montanum, *Linn.*
umbellatum, *Desv.*

Androsace
lactiflora, *Fisch.*

Anemone
alpina, *Linn.*
rivularis, *Buch.-Ham.*
sylvestris, *Linn.*

Anthericum
Liliago, *Linn.*

Anthriscus
sylvestris, *Hoffm.*

Antirrhinum
Asarina, *Linn.*

Aquilegia
chrysantha, *A. Gray.*

Arabis
alpina, *Linn.*
— var. anachoretica, *Port.*
blepharophylla, *Hook.* et *Arn.*
hirsuta, *Scop.*

Arctium
Lappa, *Linn.*

Arenaria
gracilis, *Kit.*
graminifolia, *Schrad.*
juniperina, *Linn.*
peploides, *Linn.*

Arnica
amplexicaulis, *Nutt.*
montana, *Linn.*

Arracacia
arguta, *Benth.* et *Hook. f.*

Aster
Tripolium, *Linn.*

Astragalus
alopecuroides, *Linn.*
Glyciphyllos, *Linn.*
danicus, *Linn.*, var. albus.
xiphocarpus, *Benth.*

Astrantia
gracilis, *Bartl.*
helleborifolia, *Salisb.*
major, *Linn.*
— var. intermedia.
neglecta, *C. Koch* et *Bouché.*

Atriplex
Babingtonii, *Woods.*

Atropa
Belladonna, *Linn.*

Aubrietia
deltoidea, *DC.*
erubescens, *Griseb.*

Barbarea
vulgaris, *R. Br.*

Berberis
angulosa, *Wall.*

Betula
alba, *Linn.*

Brassica
campestris, *Linn.*
juncea, *Coss.*

Brodiæa
Douglasii, *S. Wats.*

Bryonia
dioica, *Jacq.*

Bulbinella
Hookeri, *Benth.* et *Hook. f.*

Bupleurum
Candollei, *Wall.*

Callirhoë
digitata, *Nutt.*

Campanula
Cervicaria, *Linn.*
glomerata, *Linn.*
linifolia, *Scop.*
mirabilis, *Alboff.*
persicifolia, *Linn.*, var. alba.
pulla, *Linn.*
rotundifolia, *Linn.*

Carbenia
benedicta, *Adans.*

Carduus
acanthoides, *Linn.*

Cenia
turbinata, *Pers.*

Centaurea
macrocephala, *Puschk.*
nervosa, *Willd.*
pectinata, *Linn.*
Rhaponticum, *Linn.*

Cephalaria
tatarica, *Schrad.*
— var. minor.

Cerastium
alpinum, *Linn.*
tomentosum, *Linn.*

Chærophyllum
aromaticum, *Linn.*
aureum, *Linn.*

Chelidonium
majus, *Linn.*
— var. laciniatum.

Chenopodium
Bonus-Henricus, *Linn.*

Chrysanthemum
Leucanthemum, *Linn.*
segetum, *Linn.*

Cistus
laxus, *Hort.*
monspeliensis, *Linn.*

Clematis
Fremonti, *S. Wats.*

Cnicus
canus, *Roth.*
eriophorus, *Roth.*
tartaricus, *Willd.*

Cochlearia
glastifolia, *Linn.*

Collinsia
bicolor, *Benth.*

Collomia
grandiflora, *Dougl.*

Conium
maculatum, *Linn.*

Cotoneaster
frigida, *Wall.*
Nummularia, *Fisch.* et *Mey.*
rotundifolia, *Wall.*
Simonsii, *Baker.*

Cotyledon
Umbilicus, *Linn.*

Crepis
sibirica, *Linn.*

Cytisus
biflorus, *L'Hérit.*
canescens, *Hort.*
schipkaensis, *Hort.*
scoparius, *Link.*
— var. albus.
— var. Andreanus.

Dahlia
Merckii, *Lehm.*

Delphinium
altissimum, *Wall.*
cardinale, *Hook.*
hybridum, *Steph.*
Maackianum, *Regel.*
nudicaule, *Torr.* et *Gray.*
occidentale, *S. Wats.*
speciosum, *Bieb.*, var. turkestanicum.

Dianthus
Armeria, *Linn.*
barbatus, *Linn.*
cæsius, *Sm.*
ciliatus, *Guss.*

Dianthus—*continued.*
deltoides, *Linn.*
petræus, *Waldst.* et *Kit.*, var. spiculifolius.
plumarius, *Linn.*
pubescens, *Sibth.* et *Sm.*
squarrosus, *Bieb.*

Digitalis
purpurea, *Linn.*

Dodecatheon
Meadia, *Linn.*, var. album.

Draba
Aizoon, *Wahlenb.*
arabisans, *Michx.*
aurea, *Vahl.*
bruniæfolia, *Stev.*
cuspidata, *Bieb.*
hirta, *Linn.*
incana, *Linn.*
Loiseleurii, *Boiss.*

Enkianthus
japonicus, *Hook. f.*

Epilobium
angustifolium, *Linn.*
Dodonæi, *Vill.*
Lamyi, *Schultz.*
parviflorum, *Schreb.*

Erigeron
glabellus, *Nutt.*, var. mollis.

Erodium
Botrys, *Bertol.*

Eryngium
alpinum, *Linn.*
Bourgati, *Gouan.*
Oliverianum, *Delar.*

Erysimum
rupestre, *DC.*
thyrsoideum, *Boiss.*

Eschscholzia
cæspitosa, *Benth.*
californica, *Cham.*

Euonymus
europæus, *Linn.*

Fraxinus
excelsior, *Linn.*

Funkia
Sieboldiana, *Hook.*

Galega
orientalis, *Lam.*

Galium
saccharatum, *All.*

Genista
anglica, *Linn.*
hispanica, *Linn.*
præcox, *Hort.*
sagittalis, *Linn.*

Gentiana
asclepiadea, *Linn.*
Cruciata, *Linn.*
linearis, *Froel.*
Saponaria, *Linn.*
septemfida, *Pall.*
tibetica, *King.*

Geranium
pratense, *Linn.*
Robertianum, *Linn.*
sanguineum, *Linn.*
— var. lancastriense.
sylvaticum, *Linn.*, var. album.

Gerbera
nivea, *Sch. Bip.*

Geum
Heldreichii, *Hort.*
hispidum, *Fries.*
japonicum, *Thunb.*
montanum, *Linn.*, var. aurantiacum.
strictum, *Ait.*

Gilia
dichotoma, *Benth.*
minima, *A. Gray*, var. cœrulea.
tricolor, *Benth.*

Hedysarum
microcalyx, *Baker.*
neglectum, *Ledeb.*

Helianthemum
canum, *Boiss.*
umbellatum, *Mill.*

Heracleum
asperum, *Bieb.*
Wallichii, *DC.*

Heuchera
americana, *Linn.*
bracteata, *Ser.*
cylindrica, *Dougl.*
Drummondi, *Hort.*

Hieracium
bupleuroides, *C. C. Gmel.*
cambricum, *F. J. Hanb.*
foliosum, *Waldst.* et *Kit.*
gymnocephalum, *Griseb.*

Hydrangea
vestita, *Wall.*

Hydrastis
canadensis, *Linn.*

Hyoscyamus
niger, *Linn.*

Hypericum
Androsæmum, *Linn.*
Ascyron, *Linn.*
elodeoides, *Choisy.*
erectum, *Thunb.*
hirsutum, *Linn.*
rhodopeum, *Friv.*
tetrapterum, *Fries.*

Hypochœris
radicata, *Linn.*

Iberis
sempervirens, *Linn.*

Ilex
Aquifolium, *Linn.*

Iris
Guldenstaedtiana, *Lepech.*
longipetala, *Herb.*
sibirica, *Linn.*

Isatis
tinctoria, *Linn.*

Jasione
montana, *Linn.*

Jurinea
glycacantha, *DC.*

Kniphofia
Tuckii, *Baker.*

Laburnum
alpinum, *J. S. Presl.*
— var. roseum.
vulgare, *J. S. Presl*, var. foliis aureis.

Lagurus
ovatus, *Linn.*

Lathyrus
Clymenum, *Linn.*
macrorrhizus, *Wimm.*
maritimus, *Bigel.*
montanus, *Bernh.*
splendens, *Kellogg.*

Lavatera
trimestris, *Linn.*

Layia
elegans, *Torr.* et *Gray.*

Leontodon
hispidus, *Linn.*

Leontopodium
alpinum, *Cass.*, var. himalayanum.

Leptosyne
Stillmannii, *A. Gray.*

Leycesteria
formosa, *Wall.*

Ligusticum
Thomsoni, *C. B. Clarke.*

Limnanthes
Douglasii, *R. Br.*

Linaria
maroccana, *Hook. f.*
repens, *Mill.*
saxatilis, *Hoffmgg.* et *Link.*
triornithophora, *Willd.*
vulgaris, *Mill.*

Linum
capitatum, *Kit.*
usitatissimum, *Linn.*

Lophosciadium
meifolium, *DC.*

Lotus
siliquosus, *Linn.*

Lupinus
arboreus, *Linn.*
— var. violaceus.
micranthus, *Dougl.*
nootkatensis, *Donn.*
polyphyllus, *Lindl.*
rivularis, *Dougl.*

Lychnis
alba, *Mill.*
Flos-jovis, *Désr.*
montana, *S. Wats.*
Viscaria, *Linn.*

Malva
sylvestris, *Linn.*

Matricaria
Tchihatchewii, *Hort. Kew.*

Meconopsis
cambrica, *Vig.*
Wallichii, *Hook.*, var. fusco-purpurea.

Medicago
carstiensis, *Wulf.*
Echinus, *DC.*
falcata, *Linn.*
hispida, *Gaertn.*, var. apiculata.
lupulina, *Linn.*
sativa, *Linn.*
scutellata, *All.*

Meum
athamanticum, *Jacq.*

Mimulus
luteus, *Linn.*

Molopospermum
cicutarium, *DC.*

Monolepis
trifida, *Schrad.*

Moræa
iridioides, *Linn.*

Morina
longifolia, *Wall.*

Muscari
Argæi, *Hort.*
armeniacum, *Baker.*
Maweanum, *Baker.*

Myrrhis
odorata, *Scop.*

Nepeta
nuda, *Linn.*
spicata, *Benth.*

Nicotiana
rustica, *Linn.*

Œnothera
amœna, *Lehm.*

Onobrychis
viciæfolia, *Scop.*

Ononis
arvensis, *Linn.*
albo-roseum, *Fisch.* et *Mey.*

Oxytropis
glabra, *DC.*
lapponica, *Gaud.*

Pæonia
corallina, *Retz.*

Papaver
orientale, *Linn.*, var. bracteatum.
pilosum, *Sibth.* et *Sm.*
rupifragum, *Boiss.* et *Reut.*
somniferum, *Linn.*

Pentstemon
barbatus, *Roth.*
confertus, *Dougl.*
diffusus, *Dougl.*
gentianoides, *Poir.*

Perezia
multiflora, *Less.*

Phormium
tenax, *Linn. f.*

Phyteuma
orbiculare, *Linn.*
Scheuchzeri, *All.*
Sieberi, *Spreng.*

Pimpinella
magna, *Linn.*
Saxifraga, *Linn.*

Pisum
sativum, *Linn.*

Platystemon
californicus, *Benth.*

Polemonium
boreale, *Adams.*
cæruleum, *Linn.*
himalayanum, *Baker.*
mexicanum, *Cerv.*
pauciflorum, *S. Wats.*

Polygonum
baldschuanicum, *Regel.*
Convolvulus, *Linn.*
Weyrichii, *F. Schmidt.*

Potentilla
ambigua, *Jacq.*
andicola, *Benth.*
apennina, *Tenore.*
argentea, *Linn.*, var. calabra.
bifurca, *Linn.*
chinensis, *Ser.*
chrysantha, *Trevir.*
desertorum, *Bunge.*
Dombeyi, *Nestl.*
glandulosa, *Lindl.*
Hopwoodiana, *Sweet.*
Macnabiana ×, *Lem.*
multifida, *Linn.*
nepalensis, *Hook.*
nivea, *Linn.*
norvegica, *Linn.*
opaca, *Linn.*
palustris, *Scop.*
pensylvanica, *Linn.*
recta, *Linn.*
rupestris, *Linn.*
semilaciniata, *Hort.*
vladnizensis, *Siegfr.*

Poterium
canadense, *A. Gray.*
diandrum, *Hook. f.*

Prenanthes
purpurea, *Linn.*

Primula
apennina, *Wid.*
Balbisii, *Lehm.*, var. bellunensis.
elatior, *Hill.*
japonica, *A. Gray*, var. lilacina.

Primula—*continued.*
mollis, *Nutt.*
officinalis, *Jacq.*
sikkimensis, *Hook. f.*

Pulicaria
vulgaris, *Gaertn.*

Ramondia
pyrenaica, *Rich.*

Ranunculus
acris, *Linn.*
brutius, *Tenore.*
Flammula, *Linn.*
lanuginosus, *Linn.*
ophioglossifolius, *Vill.*
sceleratus, *Linn.*
Thora, *Linn.*

Raphanus
Raphanistrum, *Linn.*

Rosa
rugosa, *Thunb.*

Rumex
maritimus, *Linn.*

Salvia
hians, *Royle.*
pratensis, *Linn.*

Saponaria
ocymoides, *Linn.*

Saxifraga
Aizoon, *Jacq.*
aretioides, *Lapeyr.*
cæsia, *Linn.*
cæspitosa, *Linn.*
Cymbalaria, *Linn.*
decipiens, *Ehrh.*

Saxifraga—*continued.*
granulata, *Linn.*
Haworthii, *Hort.*
Hostii, *Tausch.*
Huetiana, *Boiss.*
hypnoides, *Linn.*
Mertensiana, *Bongard.*
nivalis, *Linn.*
pedatifida, *Ehrh.*
pubescens, *Pourr.*
Rocheliana, *Sternb.*, var. coriophylla.
squarrosa, *Sieber.*
umbrosa, *Linn.*, var. serratifolia (*Mackay*).

Scabiosa
caucasica, *Bieb.*

Scorpiurus
muricata, *Linn.*

Senecio
Doronicum, *Linn.*
Fuchsii, *C. C. Gmel.*

Silene
alpestris, *Jacq.*
caucasica, *Boiss.*
Cucubalus, *Wibel.*
Czerei, *Boiss.*
italica, *Pers.*
maritima, *With.*
nocteolens, *Webb* et *Berth.*
quadridentata, *Pers.*
rhynchocarpa, *Boiss.*
Saxifraga, *Linn.*
stylosa, *Bunge.*
Thorei, *Duf.*
verecunda, *S. Wats.*
Zawadzkii, *Herbich.*

Sisyrinchium
angustifolium, *Mill.*, var. mucronatum (*Michx.*).

Smyrnium
Olusatrum, *Linn.*

Solidago
Virgaurea, *Linn.*

Spiræa
Aruncus, *Linn.*
palmata, *Thunb.*

Stachys
recta, *Linn.*

Stenanthium
angustifolium, *Kunth.*

Succowia
balearica, *Medic.*

Symphoricarpus
racemosus, *Michx.*

Synthyris
reniformis, *Benth.*

Taxus
baccata, *Linn.*

Thalictrum
glaucum, *Desf.*
majus, *Jacq.*
minus, *Linn.*
simplex, *Linn.*

Thermopsis
fabacea, *DC.*
lanceolata, *R. Br.*

Tofieldia
calyculata, *Wahlenb.*

Trifolium
alpinum, *Linn.*
pannonicum, *Linn.*
striatum, *Linn.*

Trollius
altaicus, *Mey.*

Tunica
prolifera, *Scop.*

Valeriana
tuberosa, *Linn.*

Veratrum
album, *Linn.*

Veronica
officinalis, *Linn.*

Vicia
Cracca, *Wulf.*
oroboides, *Wulf.*
Orobus, *DC.*
pyrenaica, *Pourr.*
sylvatica, *Linn.*
villosa, *Roth.*

Viola
cornuta, *Linn.*
hirta, *Linn.*
sylvestris, *Lam.*

Wulfenia
carinthiaca, *Jacq.*

PLANTS UNDER GLASS.

Acacia
Farnesiana, *Willd.*
grandis, *Henfr.*
juncifolia, *Benth.*
neriifolia, *A. Cunn.*
suaveolens, *Willd.*

Acanthostachys
strobilacea, *Link, Klotzsch* et *Otto.*

Æchmea
bromeliæfolia, *Baker.*
— var. pulchrum.
candida, *E. Morr.*
cœrulescens, *Baker.*
Makoyana, *Hort. Makoy.*
Weilbachii, *Dietr.*, var. leodiensis.
xiphophylla, *Baker.*

Agave
attenuata, *Salm-Dyck.*
xalapensis, *Roezl.*

Aglaonema
commutatum, *Scholt.*

Aloe
mitriformis, *Mill.*, var. spinulosa (*Salm-Dyck*).
striata, *Haw.*

Araujia
sericifera, *Brot.*

Aristolochia
brasiliensis, *Mart.* et *Zucc.*
elegans, *Mast.*
fimbriata, *Cham.*

Asclepias
curassavica, *Linn.*

Astrocaryum
mexicanum, *Liebm.*

Begonia
Dregei, *Otto* et *Dietr.*
semperflorens, *Link* et *Otto.*
Verschaffeltii ×, *Regel.*
Weltoniensis ×, *Hort.*

Bertolonia
maculata, *DC.*

Billardiera
longiflora, *Labill.*

Billbergia
pallidiflora, *Liebm.*
thyrsoidea, *Mart.*, var. longifolia.
zebrina, *Lindl.*

Brachychilum
Horsfieldii, *Baker.*

Brodiæa
lactea, *S. Wats.*

Callicarpa
purpurea, *Juss.*

Callistemon
linearis, *DC.*
speciosus, *DC.*

Carex
japonica, *Thunb.*

Cassia
corymbosa, *Lam.*

Cedronella
triphylla, *Moench.*

Chamædorea
Sartorii, *Liebm.*

Chlorophytum
Orchidastrum, *Lindl.*

Cleome
gigantea, *Linn.*

Clerodendron
splendens, *G. Don.*

Clianthus
puniceus, *Banks* et *Sol.*

Clitoria
Ternatea, *Linn.*
— var. alba.

Cobæa
scandens, *Cav.*

Coffea
arabica, *Linn.*
bengalensis, *Roxb.*

Costus
afer, *Ker-Gawl.*
igneus, *N. E. Br.*

Crossandra
undulæfolia, *Salisb.*

Cytisus
candicans, *Lam.*

Desmodium
gyrans, *DC.*

Didymosperma
porphyrocarpon, *H. Wendl.* et *Drude.*

Dolichos
Lablab, *Linn.*

Drosera
spathulata, *Labill.*

Drosophyllum
lusitanicum, *Link.*

Eccremocarpus
scaber, *Ruiz* et *Pav.*

Eriostemon
buxifolius, *Sm.*

Erythrochiton
brasiliensis, *Nees.*

Eucalyptus
ficifolia, *F. Muell.*
incrassata, *Labill.*

Eucomis
punctata *L'Hérit.*

Eupatorium
Weinmannianum, *Regel.*

Evodia
elegans, *Hort.*

Fuchsia
procumbens, *R. Cunn.*

Gasteria
disticha, *Haw.*, var. angustifolia, *Baker.*

Geonoma
pumila, *Wendl.*

Gerbera
Jamesoni, *Bolus.*

Gloriosa
superba, *Linn.*

Goodia
lotifolia, *Salisb.*

Gossypium
herbaceum, *Lam.*

Grevillea
glabrata, *Meissn.*

Guizotia
abyssinica, *Cass.*

Hedychium
Gardnerianum, *Rosc.*

Hibiscus
gossypinus, *Thunb.*
Manihot, *Linn.*
pedunculatus, *Linn.*
Trionum, *Linn.*, var. major.

Humea
elegans, *Sm.*

Hydrolea
spinosa, *Linn.*

Indigofera
atropurpurea, *Buch.-Ham.*
australis, *Willd.*

Ipomœa
Bona-Nox, *Linn.*

Kalanchoë
crenata, *Haw.*
flammea, *Stapf.*
thyrsiflora, *Harv.*
Welwitschii, *Britten.*

Kennedya
prostrata, *R. Br.*
— var. Marryatæ.

Kunzea
parvifolia, *Schau.*

Lantana
Camara, *Linn.*

Leptospermum
ericoides, *A. Rich.*
scoparium, *Forst.*

Loasa
lateritia, *Gill.*, var. aurantiaca, *Hort.*

Luffa
ægyptiaca, *Mill.*

Lycopersicum
esculentum, *Mill.*

Maurandia
Barclayana, *Lindl.*

Melothria
cucumerina, *Naud.*

Mesembryanthemum
curviflorum, *Haw.*
digitiforme, *Thunb.*
lepidum, *Haw.*
sanguineum, *Hort.*
violaceum, *DC.*

Mimosa
marginata, *Lindl.*

Mimulus
longiflorus, *Hort.*

Momordica
Charantia, *Linn.*
cochinchinensis, *Spreng.*

Moræa
prolongata, *Hort.*

Musschia
Wollastoni, *Lowe.*

Myrica
æthiopica, *Linn.*

Myrtus
communis, *Linn.*
Luma, *Barn.*
Ugni, *Mol.*

Nephthytis
liberica, *N. E. Br.*

Nicotiana
sylvestris, *Hort.*

Ornithogalum
tenellum, *Jacq.*

Oryza
latifolia, *Desv.*
sativa, *Linn.*

Oxypetalum
cœruleum, *Desne.*

Panicum
Crus-galli, *Linn.*

Passiflora
edulis, *Sims.*
quadrangularis, *Linn.*

Pelargonium
ternatum, *Linn.*

Pitcairnia
amaryllidifolia, *Hort.*
latifolia, *Soland.*
maidifolia, *Desne.*
pulverulenta, *Ruiz* et *Pav.*

Polyalthia
suberosa, *Benth.* et *Hook. f.*

Primula
japonica, *A. Gray*, var. lilacina.
mollis, *Nutt.*
verticillata, *Forsk.*

Prostanthera
lasianthos, *Labill.*

Rhodochiton
volubile, *Zucc.*

Rhododendron
Nuttallii, *Booth.*

Rhynchosia
caribæa, *DC.*

Rivina
humilis, *Linn.*

Ruellia
tuberosa, *Linn.*

Sabal
Blackburniana, *Glazebr.*

Saxifraga
Cotyledon, *Linn.*, var. pyramidalis.
Macnabiana, *Hort.*

Schismatoglottis
Rœbelini, *Hort.*

Sempervivum
annuum, *C. Sm.*
tectorum, *Linn.*

Solanum
auriculatum, *Ait.*
coagulans, *Hort.*
fastigiatum, *Willd.*
hybridum, *Jacq.*
jasminoides, *Paxt.*
nigrum, *Linn.*
pyracanthum, *Jacq.*
Seaforthianum, *Andr.*

Stachytarpheta
indica, *Vahl.*

Tacca
cristata, *Jack.*

Tacsonia
exoniensis ×, *Hort.*
mollissima, *H.B.K.*
Van, Volxemii, *Hook.*

Tecoma
Smithii, *Hort.*

Tetranema
mexicana, *Benth.*

Thrinax
parviflora, *Sw.*

Tillandsia
aurea, *Hort.*
corallina, *K. Koch.*
splendens, *Brong.*

Trachelium
cœruleum, *Linn.*

Tristania
laurina, *R. Br.*

Villamilla
purpurascens, *Hort.*

Vitis
heterophylla, *Thunb.*, var. humulifolia.

NOTES

FROM THE

ROYAL BOTANIC GARDEN,

EDINBURGH.

NOVEMBER 1901.

CONTENTS.

SOLD AT THE GARDEN

(PRICE EIGHTEENPENCE)

History of the Royal Botanic Garden, Edinburgh.

PRINCIPAL GARDENERS.

Of the chiefs of the Garden-staff of the Royal Botanic Garden in its earliest years we have at present no record. Search through documents relating to the period may bring to light some information regarding them, but search of the kind demands more leisure than I am able to claim. From the year 1764, in which the Garden, under Professor John Hope, was for the first time recognised as claiming the direct financial support of the Crown, we have a record which, imperfect though it be, enables us to draw up the following list of the names of men who have held the position of head of the Garden-staff here :—

John Williamson,	Principal Gardener,	1756(?)-1780.
Malcolm M'Coig,	Principal Gardener,	1782-1789.
Robert Menzies,	Principal Gardener,	1789-1799(?)
John Mackay,	Principal Gardener,	1800-1802.
George Don,	Principal Gardener,	1802-1806(?)
Thomas Sommerville,	Principal Gardener,	1806(?)-1810.
William Macnab,	Principal Gardener,	1810-1848.
James Macnab,	Principal Gardener,	1849-1878.
John Sadler,	Curator,	1879-1882.
Robert Lindsay,	Curator,	1883-1896.
Adam Dewar Richardson,	Head Gardener,	1896-1902.
Robert Lewis Harrow,	Head Gardener,	1902.

I may say a word in explanation of the variation in title given to the chief of the Garden-staff in the foregoing table. All the earlier chiefs of the Garden-staff had the official designation, Principal Gardener. At the end of the eighteenth century it had

become usual on the part of the public to speak of this official as Superintendent, and in newspaper references this term is commonly made use of, although all official documents refer to the Gardener or Principal Gardener. This continued up to the appointment of William Macnab in 1810. James Macnab received no official appointment from the Crown; he was appointed verbally by the Regius Keeper of the day to succeed his father, an appointment confirmed subsequently by the Crown when in time the fact of the succession became known to it. James Macnab was spoken of by the public as Superintendent, but in his later years the newer title of Curator became the customary one. On James Macnab's death John Sadler was recommended for the post of Curator, and the Crown accepting without question the designation made the appointment, and the title was continued to his successor. On the retirement of Robert Lindsay the old designation of Gardener was reverted to.

John Williamson.

He was Principal Gardener during the period in which the Royal Botanic Garden was established in Leith Walk, taking the place of the pre-existing gardens at Holyrood and at the east end of the North Loch. We have little knowledge of him beyond what is recorded on a memorial tablet in the Garden which bears:—

To the memory of | John Williamson, | who during twenty-five years of faithfull service | as Principal Gardener in this place, was no less | respected for the good qualities suited to his | station in life, than esteemed for eminent skill in | his profession, this monument is erected by | John Hope: PB: 1781. | Removed from the Botanic Garden, | Leith Walk, | 2nd September, 1823.

The words "this place" on the tablet are, in the strict sense, inaccurate, for the Garden was only established in Leith Walk in 1764, and Williamson to put in twenty-five years' service as Principal Gardener must have been appointed by Professor Alston—say in 1756. We may assume, however, from their use that the Royal Garden and the Town's Garden prior to their

combination had under the Regius Keeper and Professor one Principal Gardener, who was John Williamson.

The laying-out of the new Garden in Leith Walk was a matter of supreme interest to Professor Hope, and in John Williamson he had apparently an efficient coadjutor. Hugo Arnot,[1] describing the Garden in 1779, speaks of its development, and says "this rapid progress of the Garden was much owing to the skill and diligence of John Williamson, the Principal Gardener."

Of John Williamson's sympathetic collaboration in scientific work in the Garden there is evidence in a manuscript book marked, "A narrative of experiments made on trees in the Botanic Garden," which is amongst the books and papers of Professor Hope bequeathed to the Garden by the late John Hope, W.S. In this book there is an account of five experiments carried out in the year 1769. The subjects of investigation were the movement of the sap, the polarity of the branches, the growth of the wood in the stem, and the relation of the parts of the flower to the ripening of the seed. Examination of the records in the book lead to the conclusion that the daily observations and notes were made by John Williamson under the direction of Professor Hope. The outcome of the experiments is nowhere recorded, but the experiments themselves are of interest as giving us some idea of problems of plant-life that attracted attention in the eighteenth century, and they testify to the diligence and enthusiasm of John Williamson.

John Williamson died[2] in 1780 and was buried on 24th September of that year in St. Cuthbert's Burying Ground.[3] He left two sons, who lived in 8 Church Street, Edinburgh, one,

[1] Hugo Arnot, "The History of Edinburgh," 1779, p. 418, Footnote.

[2] The friendly intervention of the late Mr. John Hope, W.S., brought me into relation with Mr. Andrew F. Kedslie, 12 St. Vincent Street, Edinburgh, and through his kindness I have learned from his aunt, Mrs. Agnes Armand, great-granddaughter of John Williamson, that she has some recollection of being told by her mother that John Williamson was shot at and killed in Leith Walk. To the same source I am indebted for the information in the text regarding John Williamson's family.

[3] "John Williamson from the Botanest Gardens a turf."—*Register of St. Cuthbert's Burying Ground, September 24th, 1780.*

Samuel, who was educated by Professor Hope and became a doctor in the Indian service; the other, James, was blind. He also had a daughter, Nancy, who married the well-known Dr. Andrew Fyfe, Lecturer on Anatomy.[1]

The successor to Williamson apparently was not appointed at once for I find in the Pipe Roll[2] a record of payment of two guineas "to Mr. Knox for superintending the Garden after Mr. Williamson's death," and in the same Pipe Roll "John Bell, gardener," is credited with disbursements for the Garden, these being "wages and petty expenses," the amount of which, £109 17s. 8d., shows that he was acting as paymaster for some little time. John Bell does not seem to have been appointed Principal Gardener, and was perhaps the senior working gardener in the Garden acting at first under the direction of Mr. Knox, and subsequently taking independent charge. Whether a Mr. Richmond, who, according to the same Pipe Roll, received a sum of £2 3s. at this time—for what service is not stated—was also a temporary superintendent, perhaps following Mr. Knox, there is at present no means of deciding, but the position of his name in the Pipe Roll, and the amount and statement of the payment he received, make the conjecture that he so acted a legitimate one.

Malcolm M'Coig.

By the 1st January 1782 a new Principal Gardener had been appointed in the person of Malcolm M'Coig, and he continued in this position until his death on the 25th February 1789. He therefore survived Professor Hope, who died in 1787, and he was Principal Gardener when Professor Rutherford became Regius Keeper. Regarding M'Coig we have no further information as yet, but that he was a man of some vigour, and of better education than John Williamson, is shown by papers among our Hope MSS. assigned to his authorship by Professor Hope, in which he makes proposals for various changes in the laying-out of the Garden.

[1] "Last night was married Mr. Andrew Fyfe of this place to Nancy Williamson."—*Caledonian Mercury, October 20th, 1787.*

[2] Pipe Roll.—"The declaration of the accounts of Doctor John Hope, Regius Professor of Botany in the University of Edinburgh, of the money received and paid by him on account of the Botanic Garden there from 11th March 1769 to 1st January 1782."

Robert Menzies.

On M'Coig's death Robert Menzies was appointed his successor. Of him we can tell little. He was probably a native of Weem in Perthshire, and was elder brother of Archibald Menzies, a distinguished botanist and traveller, who, as a young man, was also employed in the Botanic Garden, and apparently under his brother.[1] The Pipe Roll for the later years of the eighteenth century is missing from the series, and therefore I am not able to determine the exact date of the death of Menzies, but from a statement by Dr. Neill[2] we know that his successor in the Garden was appointed in February 1800.

John Mackay.

The successor of Robert Menzies was John Mackay, brother of James Townsend Mackay, the distinguished botanist whose name will always be associated with the investigation of the flora of Ireland. John Mackay's name is familiar to British botanists, for it occurs frequently in the pages of British floras, but we depend for our knowledge of the incidents of his career upon the following memoir, from the pen of Dr. Neill, which appeared in the "Scots Magazine" for 1804:—

SHORT BIOGRAPHICAL MEMOIR OF THE LATE MR. JOHN MACKAY, SUPERINTENDENT OF THE ROYAL BOTANIC GARDEN AT EDINBURGH.

Almost two years have elapsed since the death of this exeellent young botanist; and hitherto no account (as far as I have observed) has been given to the public, of his professional excellence, the progress he had made in botany, and the services he rendered to that science, or of the many amiable qualities of his personal character.

The writer of the following short memoir is conscious of his inability to do justice to the subject. But however imperfect his

[1] The biographical notices of Archibald Menzies in Proc. Linn. Soc., vol. i. (1849), p. 139, and in the D. N. B., give in error "William" as the name of this brother who was Principal Gardener of the Royal Botanic Garden.

[2] See below in the memoir of John Mackay.

account may be, he is certain that it will be gratifying, especially to Mr. Mackay's *botanical* friends, to see some faint memorial of his merits put upon record. The writer had the pleasure of living in habits of intimacy with him during the last three years of his life, and has since had the advantage of enjoying the friendship and confidence of his surviving brothers.

A life so short, and spent in study, cannot be expected to afford incidents for a formal or extensive biographical narrative. Mr. Mackay, indeed, never acted a conspicuous public part; he made no voyage of discovery, he published no botanical work. He was cut down almost at his very entrance into public notice. The materials therefore being scanty, the narrative must appear simple and concise, and not calculated to excite general interest. The most promising traces of future eminence will, however, be discerned, in the earliness of his passion for botany, his zeal in traversing the mountains of Scotland in search of plants, his uncommon assiduity in every pursuit he undertook, and the acuteness of his discriminating powers, as testified[1] by the most competent of judges, Dr. JAMES EDWARD SMITH, the President of the Linnean Society.

Mr. JOHN MACKAY was born at Kirkcaldy, December 25, 1772. His father, Mr. Hugh Mackay (who survives him,) is professionally a gardener. His mother (who died many years ago) was Margaret Mitchel, from Auchinleck in Ayrshire.

While John was yet a boy at school he discovered a strong predilection for the cultivating of plants. Even at the age of 14 he had formed a very considerable collection of the rarer kinds of garden and hot-house plants. This was at Inveresk, whither his father had removed.

In the beginning of 1791 young John was placed in Dickson and Company's[2] nurseries, Leith Walk, unquestionably the most extensive and best conducted in Scotland, and a most excellent school for a young botanist.

[1] In Sowerby's "English Botany."

[2] George Don, hereafter referred to, was acquainted with the Dicksons. See Gardiner, Flora of Forfarshire, 1848, Introduction, p. xii.—*I. B. B.*

During a part of the summer of this year he assisted the late Mr. Robert Menzies (brother to Mr. Archibald Menzies, travelling botanist to the King) in serving to the Professor and students the plants required at the botanical lectures in the Royal garden Edinburgh. I can state, on good authority, that, in the short space of six weeks, this hopeful young botanist actually collected specimens of all the plants then growing in the botanic garden. For this purpose he rose very early in the morning; in this pursuit he spent the greater part of the different hours of remission allotted for meals; and at night, after all the fatigues of a long summer day, assorted his specimens by candle-light.

After having remained some time in the nurseries of Messrs. Dicksons, Mr. Mackay engaged himself at Hopetoun House, the fine garden and pleasure-grounds of which were then (as I believe they still are) under the care of Mr. Hosey. Here he first remarked plenty of the euphorbia ezula in the belts of planting near the palace, and the silene nutans on the banks near the frith. On the opposite shore, also, he at this time found the rare astragalus uralensis. While he remained at Hopetoun Mr. Mackay spent two hours every evening with a teacher of mathematics at Queensferry; and by this sedulous application, he made very considerable progress in that science.

Towards the close of 1792, he left Hopetoun, having been invited by Messrs. Dicksons to act as clerk to their nurseries,[1] and to take the charge of the more curious plants.

It was in the course of the next year[2] that he acquired, when at Glasgow, the acquaintance of Mr. George Don, well known amongst naturalists for his zeal in practical botany. Mr. Don was then by profession a clock and watch-maker, but spent generally about two days in the week in exploring the hills,

[1] His employment here led to his occasional designation as nurseryman by his correspondents in the South.—*I. B. B.*

[2] Don, in a letter to Mr. Winch, gives the date as 1791. See Memoir of George Don in these "Notes." If Mackay had been connected with Dicksons' nurseries from 1791 there would probably have been opportunities of his meeting Don before 1793, seeing that Don also was acquainted with the Dicksons, and the date 1791 given by Don is possible and not unlikely. —*I. B. B.*

rocks, and dales of his neighbourhood. He at this time[1] accompanied Mr. Mackay to the Alps of Scotland. They spent several days in exploring together the great mountain of Ben-Lawers in Bredalbane. Here Mr. Dickson of London had already found the acrostichum ilvense, lichen croceus, and fusco-luteus, &c. all of which occurred to our travellers. They likewise picked up carex rigida, originally observed by Dr. Walker, late Professor of Natural History at Edinburgh. They found, also, several plants of the very rare gentiana nivalis; and the arenaria saxatilis and cerastium alpinum were for the first time added to the British Flora by this expedition. On this occasion, also, Mr. Don discovered a new species of grass, which has not yet been scientifically described: it seems to rank under the genus *elymus*, and he has given it the trivial name of *alpinus*. Of this rarity he could find only two plants.

At Blair-in-Athol our botanists attracted the notice of the D[uke] of Athol, and his sister, Lady Charlotte Murray, who has rendered herself celebrated as a botanical writer. The Duke invited them to botanize Glen Tilt, and gave orders for their accommodation at his Grace's hunting lodge in that wild district. Upon a high rock immediately opposite the lodge, they found, within a narrow space, many rare alpine plants; dryas octopetala; salices lapponica, reticulata and herbacea; pyrola secunda; carices capillaris and atrata; azalea procumbens; gnaphalium supinum; and saxifragæ oppositifolia and stellaris.

Next summer it was concerted between our botanists that they should visit some of the Western Islands of Scotland in company. Mr. Don accordingly, at the appointed time, set out from Forfar (which had now become the place of his residence, and where he cultivated an immense variety of the rarest hardy plants[2]:)

[1] Although Dr. Neill uses this indefinite expression, we have confirmation of the date 1793 in Don's statement that he gathered Arenaria rubella in this year in company with Mackay. See Garry, "Notes on the Drawings for English Botany" in Journal of Botany, April 1903, p. 35.—*I. B. B.*

[2] If Dr. Neill's date be correct we have the time of Don's migration from Glasgow to Forfar fixed as the end of 1793 or beginning of 1794. See further regarding this on p. 61 of these "Notes."—*I. B. B.*

Mr. Mackay was to meet him; but being by some means detained a few days, they missed each other. Mr. Mackay, however, found no difficulty in tracing Mr. Don's route; the great length of his botanical spade,[1] and the singularity of his occupation in clambering rocks and mountains to get at *weeds*, having arrested the attention, and excited the astonishment of the honest Highlanders. Altho deprived of the advantage of mutual communication, several rare plants rewarded their labours. Besides most of those previously discovered by Dickson of Covent Garden in 1789 and 1790 (such as Draba stellata, phleum alpinum, cherleria sedoides, &c.,) they found several species new to the Scottish Flora, as juncus castaneus (Jacquini) and juncus biglumis, Saxifraga cernua, and Festuca calamaria.[2]

This journey occupied sixteen weeks, which Mr. Mackay spent in unwearied botanizing. On the Highland mountains, when far from an inn, or other habitation he sometimes passed the night in a deserted *shealing*,[3] a temporary hut that had been raised by the native Highlanders some former season. In the Island of Sky Mr. Mackay discovered a scirpus, intermediate between S. pauciflorus and palustris, and which has received the name of *multicaulis*.[4]

The investigation and assortment of the ample stores of cryptogamia which he accumulated in this journey, occupied him during the evenings of the following winter. The mosses and lichens were all examined by candle-light, after the business of the day; and too often were his investigations pursued through the greater part of the night.

[1] An ash rod, fifteen feet in length, with an iron spaddle fixed to its end. The spaddle has a notch, which serves as a hook to pull down plants from inaccessible crevices in rocks.

[2] Statistical Account of Scotland, parish of Kenmore, by the Rev. Colin Macvean. The festuca calamaria is the non-descript grass referred to by the Reverend Author.

[3] During winter the Highlanders are collected into villages in the valleys; but they remove to the mountains every summer, in order to pasture their cattle. The whole family migrates: it is called the *summer flitting*. A temporary hut is reared on the hills: this hut is called a *shealing*. The term *shealing* is often used, also, to denote the range of summer pasture.

[4] Sir James E. Smith in Flora Britannica, I. (1800), p. 49, gives 1794 as the date of the finding of this plant, and this agrees with Dr. Neill's date of this second Highland excursion arranged between Mackay and Don.—*I. B. B.*

In the management of Messrs. Dicksons' nurseries, Mr. Mackay made great progress in the knowledge of the culture of plants; nor was he inattentive to matters more strictly botanical. He formed, in a plot of ground in the nurseries, a most extensive arrangement of hardy herbaceous plants, with numbered tallies. He made a similar arrangement of plants indigenous to Scotland. He likewise began the culture of the rarer alpine plants, in which he proved very successful. It is proper to add, that in these pursuits, as well as in his long journeys to the Highland mountains, he met with the greatest encouragement from the liberality and scientific taste of Messrs. Dicksons the proprietors.

Mr. Mackay's merit had now become known to several of the eminent naturalists of London. He was elected an Associate of the Linnean Society of that city, on the 16th of February 1796: In the course of this year also he received a very flattering testimony to his botanical proficiency from Dr. Smith, the President of that Society. This was contained in the elegant periodical work, intituled *English Botany* (of which Dr. Smith may be considered as the author, and Mr. Sowerby as the artist,) at the article Eriophorum alpinum. "We are obliged for wild specimens (they say) to Mr. John Mackay of Edinburgh, a most diligent and skilful investigator of the vegetable kingdom, by whose communications we have often been enriched."[1]

[1] In this work Mr. Mackay is acknowledged as a contributor of rare British plants at the following articles :—Draba incana [t. 388], Sison verticillatum [t. 395, Carum verticillatum], Cardamine hastulata [t. 469, Arabis petræa], Cerastium alpinum [t. 472], Veronica alpina [t. 484], Potentilla aurea [t. 561, P. alpestris], Subularia aquatica [t. 732], Eriocaulon septangulare [t. 733], Azalea procumbens [t. 865, Loiseleuria procumbens], Sibbaldia procumbens [t. 897, Potentilla Sibbaldi], Juncus castaneus [t. 900], Rumex digynus [t. 910, Oxyria digyna], Stellaria cerastoides [t. 911, Cerastium trigynum], Gnaphalium sylvaticum [t. 913, G. sylvaticum, var. norvegicum], Carex filiformis [t. 904], Schœnus rufus [t. 1010, Scirpus rufus], Lichen lanatus [t. 846, Cornicularia lanata], venofus [t. 887, Peltidea venosa], croceus, [t. 498, Solorina crocea], Splachnum mnioides, and several others.

[Without any profession of presentation of a complete list of species under which Mackay's work is referred to in English Botany by Sir James Edward Smith or his successors, I may add the following names to Dr. Neill's list above :—Draba hirta (D. rupestris), t. 1338; Thlaspi hirtum (Lepidium hirtum), t. 1803; Raphanus Raphanistrum, t. 856; Raphanus maritimus, t. 1643; Silene nutans, t. 465; Lychnis Viscaria, t. 788; Arenaria rubella,

In the course of summer and autumn, 1799, he made a tour of the district of Galloway, and also examined the Island of Arran. In this journey he observed a species of raphanus, which he considered as new, and used to term maritimus: Dr. Smith, however, in his *Flora Britannica*, has ranked it only as a variety γ of Raphanus raphanistrum. In this tour, mineralogy began to divide Mr. Mackay's attention with botany.

The office of Superintendent of the Royal Botanic garden of

t. 2638; Cherleria sedoides (Arenaria Cherleri), t. 1212; Spergula saginoides (Sagina Linnæi), t. 2105; Astragalus uralensis (Oxytropis uralensis), t. 466; Rosa involuta, t. 2068; Pyrus pinnatifida (fennica), t. 2331; Saxifraga pedatifida, t. 2278; Epilobium alsinefolium, t. 2000; Sium repens (Apium nodiflorum), t. 1431; Erigeron alpinus, t. 464; Antenaria hyperborea (A. dioica), t. 2640; Hedypnois Taraxaci (Leontodon autumnalis, var. pratensis), t. 1109; Hieracium villosum (H. eximium), t. 2379; Myosotis rupicola (M. alpestris), t. 2559; Veronica saxatilis, t. 1027; Euphorbia Esula, t. 1399; Salix damascena (S. nigricans, var.), t. 2709; Scirpus multicaulis, t. 1187; Scirpus glaucus (S. Tabernaemontani), t. 2321; Eriophorum alpinum, t. 311; Eriophorum polystachium (E. latifolium), t. 563; Carex filiformis, t. 904; Carex rigida, t. 2047; Carex pulla, t. 2045; Phleum alpinum, t. 519; Poa alpina, t. 1003; Poa flexuosa (P. eulaxa), t. 1123; Poa cæsia, t. 1719; Isoetes lacustris, t. 1084.

In the interesting and valuable historical record entitled "Notes on the Drawings for English Botany," prepared by Mr. F. N. C. Garry, in course of publication in the Journal of Botany, which raises the curtain from the method of production of that work and gives us particulars of the data upon which the figures and description were founded, numerous references to Mackay as well as to George Don will be found. Mackay's name is mentioned under most of the species already cited and also under the following :—Cochlearia danica, Silene acaulis, Cerastium latifolium, Stellaria glauca, Trigonella ornithopodioides, Saxifraga nivalis, Hieracium nigrescens, Veronica humifusa, Juncus biglumis.

Reference by Sir James Edward Smith to the co-operation of Mackay will also be found in Flora Britannica under the following additional species :– Hesperis inodora (H. matronalis), Brassica campestris, Silene anglica, Hieracium murorum, H. prenanthoides, Pulmonaria maritima (Mertensia maritima), Bartsia viscosa, Juncus maritimus, Carex teretiuscula, Festuca calamaria (F. sylvatica), Elymus arenarius, Splachnum fastigiatum (S. mnioides var.).

In English Flora there are further references to Mackay by Sir James Edward Smith under these species :—Œnanthe pimpinelloides, Hieracium pulmonarium (H. saxatile), H. denticulatum (H. Dewari), Lysimachia thyrsiflora, Veronica officinalis var. Allioni, Carex binervis, C. lævigata, Lolium arvense (L. perenne).—*I. B. B.*]

Edinburgh having become vacant by the death of Mr. Menzies, Mr. Mackay was appointed to that situation in February 1800. He immediately commenced many improvements on the garden, to the great satisfaction of Dr. RUTHERFORD, the Professor of Botany. During the courses of lectures in summer 1800 and 1801, Mr. Mackay occasionally accompanied the more keen and inquisitive students, in short botanical excursions around Edinburgh, a plan admirably calculated to interest the student, and to inspire that enthusiasm and those keen sensations, which enable the naturalist to look at the objects around him with feelings so different from those of mankind in general.

In the course of autumn, 1801, Mr. Mackay's friends had the mortification to remark, that his health was rapidly declining. When winter approached, he was entirely confined to his chamber. In the end of December he received a consolatory visit from Mr. Don the botanist, of Forfar.[1] Although his strength was much impaired, the society of Mr. Don recalled his wonted relish for botany, and immediately his table was covered with Cryptogamia. Even several days after his friend had taken leave of him, I was much pleased to find him still amusing himself with the assorting of mosses. Indeed, in the case of Mr. Mackay, I had frequent occasion to remark the salutary influence of enthusiasm in a favourite pursuit, in tending to divert the mind from those gloomy prospects that are apt to haunt us when under the pressure of bodily affliction.

Mr. Mackay lingered for several months, his strength gradually decaying. Before the end of March 1802 he had become bedrid. About this time he afforded a most striking proof of his invincible ardour as a botanist and florist, by desiring the hyacinths, jonquils, and other early flowers that had come in blow in the dry-stoves to be brought to his bedside, examining them and giving his opinion of them, one by one. About this period, also, a parcel of young plants of new and rare ericas, happening to arrive from some of his correspondents, he requested to see them; and, after declaring his satisfaction with them, observed, in a pathetic tone, "that he would never see them

[1] Don refers to this visit as occurring "about September." See Letter to N. J. Winch, dated Forfar, May 11, 1802.—*I. B. B.*

blow." He lingered till the 14th of April 1802, when he expired in the midst of his afflicted relatives.[1]

Thus fell, in the prime of life, a young man who bid fair, had he lived, to have reached the very summit of eminence in his profession. He possessed an acute and penetrating genius, a good taste, and a thirst for the knowledge of nature, that led him to pursue his studies with the greatest eagerness and ardour. He discharged his professional duties with unremitting assiduity; and often did he rob himself of his nightly rest in acknowledging the communications of his numerous botanical correspondents.

He was honoured with the acquaintance, friendship, and esteem of many men of science, literati, and persons of distinction about Edinburgh. Col. Brodie of Brodie, M.P. for Morayshire (a gentleman distinguished for attachment to botany) was his constant friend and patron.[2]

[1] "A plain stone has been erected to the memory of John Mackay, with a very classical inscription from the pen of Mr. Candlish, by far the best Latinist here, and whose sudden death, by apoplexy, a few days ago still overwhelms me with astonishment, he being a dear friend.

"Mr. J. T. Mackay, Dublin, was here and is gone to Ireland a short time ago. He stayed chiefly with me, and I am happy to say that in knowledge, taste, and modesty he is likely to rival his brother.

"Please mention if this come to hand, and also how I can send you a printed copy of the inscription above mentioned: 'Sacrum | memoriæ | Johannis Mackay, | Qui, | xviii^vo Calend. Maii, | anno post Christum natum M.DCCC.II^do, | viginti novem annos natus, | diem defletus obiît supremum; | mortalitate quidem expletâ, | at nondùm multiferæ naturæ amœnitatum studio: | Quique, | vivus, | ut ingenii bonitate, suâ modestia, morumque suavitate, | erat amicis unicè carus; | sic hortensis floræ deliciolas, | et rurigenam prolem, | tam indefesso pernoscendi ardore, | quàm rarâ discernendi disponendique peritiâ, | Florilegis Herbariisque acceptus: | Posuit | Frater | J. T. Mackay, | M.DCCC.V^to.'"

Smith Corresp. Linn. Soc.: Dr. Neill to Sir J. E. Smith, 9th May, 1806.

I have not discovered where this stone was erected or where Mackay was buried. The Registers of Greyfriars, St. Cuthberts, Canongate, and Calton give no information.—*I. B. B.*

[2] "A Mr. John Mackay at Messrs. Dickson's & Co., Seeds and Nursery Men Edinr., travel'd through a great part of the North and West of Scotland in search of Plants, and found a great many not noticed by Lightfoot; of these I have sent a list to Mr. Sowerby, along with some specimens of the Eriocaulon decangulare—he wishes for some in seed, I have desired Mr. Mackay if he has any in that state, to send them, along with some for you, and am persuaded he will chearfully send you specimens of any or all he

Possessed of the most extensive and accurate knowledge of botany, Mr. Mackay yet conducted himself with so much reserve in mixed company, that a stranger might long converse with him without discovering that he knew more of that science than other men. In talking of plants he always preferred the English names (where such existed,) except in conversing with known botanists.

In the course of several little botanical excursions I had the happiness to make in company with him, I could not help remarking the uncommon acuteness of his eye, in detecting the minute cryptogamia. As he glanced around, *oculis emissitiis*, he used to find the rarer little mosses and lichens in spots where his companions had observed nothing.

The power of his memory in retaining with accuracy, and recalling with the most prompt facility, the generic and specific Linnean names of between 3000 and 4000 plants, always appeared wonderful to me.

His studious habits and enthusiasm for botany did not tinge his social character, or produce any indifference for those little forms of politeness, which men absorbed in study and science are so apt to neglect. The urbanity and complacency of his manners were generally admired. His countenance habitually wore a smile; his eye was piercing, but at the same time beamed with modesty.

has collected—I do not know his situation with Mr. Dickson, but as a young man indefatigable, and an Enthusiast in pursuit of Plants, I am persuaded he will do credit to any employment procured him in that way. I have no connection with him, but was very much pleased with his knowledge of Indigenous Plants, when he passed several days here last season, and ranged through the extensive woods, along with me in this neighbourhood. I have prepared him for your directions, and am certain he will attend to them with exactness."—*Smith Corresp. Linn. Soc.: Brodie of Brodie to Sir J. E. Smith, 7th May 1795.*

"As you do not say Mr. McKay has furnished you with the Specimens of the Eriocaulon wanted I have again wrote him to that purpose—McKay is a Worthy man and an excellent Botanist to whom I often apply—as I saw him in the list of the Members of the Linnean Society, I wished him to communicate to It throw you my Discoveries in that Way—Your Good Intentions, by which I think myself much honoured, afford me the expectation of being able to do it in Future immediately Myself."—*Smith Corresp. Linn. Soc.: Brodie of Brodie to Sir J. E. Smith, 18th June 1795.—I. B. B.*

His private social virtues will not indeed ever be forgotten by his relatives and acquaintance: but as the influence of these virtues was local, their remembrance must be temporary ; it must perish in a great measure with those who witnessed them. But his fame as a botanist was already widely diffused, and will long be held in remembrance. His name will live in the annals of the Linnean Society : it is frequently recorded with honour by Dr. SMITH in the elegant botanical work already mentioned [1] ; and we may perhaps hope that that truly eminent Botanist will yet further embalm it, by connecting it with some species of plant of which he was the discoverer.

It would be improper not to take notice here, of some very neat verses to Mr. Mackay's memory, which were circulated among his acquaintance, and appeared in the "Edinburgh Evening Courant"[2] soon after his decease. They were the effusion of a worthy and most affectionate friend; and, to no small poetical merit, added the recommendation of pourtraying their subject.

LETTERS OF JOHN MACKAY.

To this sympathetic contemporaneous sketch, hitherto lost sight of, I add transcripts of some of Mackay's letters which have come under my notice, for the light they throw on his relationships with botanists of his day.

The following from Mackay to Robert Brown is preserved in the Brown Correspondence in the British Museum, Cromwell

[1] Opposite to plate 1123 of this work (*Poa flexuosa*) Dr. Smith has given the following elegantly simple eulogy of his deceased botanical friend :— "The Scottish mountain of Ben Nevis, amongst a profusion of botanical rarities, has afforded us this new species of Poa, discovered there by the late Mr. John Mackay, a young man, who sacrificed his repose, and finally his health and life, to the too ardent pursuit of botany and horticulture. His discriminating powers, and readiness of communication, will long live in the memory of those who knew him. We would never neglect the opportunity of twining a modest garland for the brows of such benefactors to science, even though it were only of grass or moss."—*English Botany, No. 135, for February 1803.*

[2] For June 3, 1802.—*I. B. B.*

Road, and I am enabled to print it here through the courtesy of the Keeper of the Botanical Department of the Museum :—

John Mackay to Robert Brown.[1]

Dear Sir,—It gave me very great pleasure indeed when I heard of your appointment to so respectable a situation as the one I now take the liberty to congratulate you in. The particulars of the expedition I have not yet heard, but understands it is to be a very complete one. Sufficiently sensable of your merits and ardour I have not a doubt of your fulfilling your part in the best manner, and sincerely hope it will turn out to a good account both for yourself and the country. Will we not have the pleasure of seeing you here before you depart, or will you find a leisure hour to write me some of the news which will be highly gratifying? In my present situation I feel myself interested in everything relating to Botany, and more stimulus than formerly. The Edin. B. Garden you know has been much neglected, but every endeavour will now be exerted to raise it to that pitch of Eminence it ought to hold among the British Gardens. We have had very considerable additions to our collection both of Indigenous and Exotic plants, and may we not hope to profit by your acquisitions. I have not given up the minute tribes, though for some time past I have had many avocations. I made a trip to the north last season, when I saw our friend G. Donn ; he is still as keen as ever in our favourite pursuit and is adding to his collection.

I have often wished to have heard of you since I had the pleasure of seeing you here. The only account I had of you for a long while was through our worthy friend Dr. Walker,[2] but about that time he was seized with a pain in his eyes which I am afraid he will never get the better of, preventing him answering your letter and also me seeing the specimens you sent him. He is still very fond of Botanical news. Mrs. Walker was also poorly, but is now much better.

You will likely have seen Mr. Jameson's[3] publications ; he is now in Germany studying under Werner.

[1] The letter is undated, but its terms show that it was written shortly after Mackay's appointment to the Edinburgh Garden, in 1800, and the congratulations it conveys refer without doubt to Brown's appointment as Naturalist to Flinder's Expedition (1801-05).

[2] Professor of Natural History in the University of Edinburgh, 1779-1804.—*I. B. B.*

[3] Professor of Natural History in the University of Edinburgh, 1804-1850.—*I. B. B.*

The bearer of this, my friend Mr. Good [1], our countryman, also may be able to give you more news. He is to accompany you, and is a very pleasant, unassuming young man. Ever since I had the pleasure of knowing him have entertained a very good opinion of him, and do not know one better qualified for the office I understand he is to hold, and should warmly recommend him to your attention.

Messrs. Fife, Ar. Bruce, Henderson, seedman, and other friends here desires to be kindly remembered to you, in hopes you will find it convenient to correspond. With best wishes for your welfare, I remain, with much goodwill,

Dear Sir, sincerely yours,

(Signed) JOHN MACKAY.

[Addressed to]
Mr. Brown,
at Sir Joseph Banks,
Soho Square,
London.

To the President and Council of the Linnean Society I am indebted for the permission to publish the following letters from the Winch Correspondence preserved by the Society. Although Mackay was so frequent a correspondent of Sir James E. Smith, not one of his letters is to be found in the Smith Correspondence now in the possession of the Linnean Society. The publication of the correspondence with Mr. Winch is of some importance on account of the localities of Scottish plants it records:—

John Mackay to N. J. Winch.

Botanic Garden, Leithwalk, Novr. 21st, 1800.

Dr Sir,—Your esteem[d] favour of the 27th Ult[o] I received and assure you few things afford me more pleasure than a new Botanical correspondant. I have annexed a list of my Desiderata any of which will be very acceptable particularly those mark[d] thus +) and which are mentioned as growing near you—most of the other British plants I now am, or expect soon to be in possession of, and will be happy to send you any of them you may want. Though I wish much to have a full collection of growing Plants

[1] Peter Good accompanied as gardener Robert Brown on Flinder's voyage.—*I. B. B.*

as soon as possible—Dryed specimens of Lichens, and other cryptogamous plants are equally interesting to me. My list of Scotch cryptogamous plants were some time ago 22 Mniums, according to With[g]. 40 Bryums, 36 Hypnums, 150 Lichens, 50 Fuci, &c. but I hope by and by to add much to it. When convenient I shall be happy to hear what rare plants grow in your neighbourhood, and also your Desiderata. I trust you will always find me open and faithfull and ready to do any thing in favour of our favourite science. In this mean time, I am, Dr Sir,

Very respectfully,

Your most obt. Servt.,

(Signed) JOHN MACKAY.

My compts. to Mr. Falla, Junr.

British Desiderata.

Salicornia fruticosa
Veronica triphyllos
Salvia pratensis
Schœnus fuscus
Cyperus longus
Scirpus Holoschœnus
„ triqueter
„ romanus
Agrostis minima
„ verticillata
Poa procumbens
„ bulbosa
+Holosteum umbellatum
Asperula cynanchica
Galium pusillum
„ scabrum
Exacum filiforme
Buffonia tenuifolia
Tiliæa muscosa
Anchusa officinalis
Hottonia palustris
Campanula hederacea
Lobelia urens
Viola lactea
Verbascum virgatum
Chironia pulchella
Ribes spicatum
„ petræum
Thesium linophyllum
Chenopodium rubrum
Gentiana Pneumonanthe
+ „ verna
Bupleurum tenuissim[m]
Echinophora spinosa
Tordylium officinale
„ maximum
Athamanta libanotis
Ligusticum cornubiense
Pimpinella dioica
Corrigiola littoralis
Statice reticulata
Ornithogalum pyrenaic[m]
Anthericum serotinum
Juncus acutus
„ filiformis
Frankenia lævis
„ pulverulenta
Alisma Damason[m]
„ natans
„ lanceolata
+Chlora perfoliata
Elatine Alsinastrum
Monotropa hypopitys
Saxifraga groenlandica
Saponaria hybrida
Dianthus denudatus

Arenaria juniperina
" laricifolia
Cotyledon lutea
Cerastium aquaticum
Spergula pentandra
Lythrum hyssopifol[m]
Euphorbia hybernia
" paralias
" peplis
Chelidon[m] laciniatum
+Cistus marifolius
" surrejanus
" anglicus
Anemone ranunculoides
Aquilegia alpina
" chamæpitys
+Galeopsis ladanum
Ballota alba
Melissa nepeta
Melampyrum cristatum
Antirrhin[m] spurium
" arvense
Dentaria bulbifera
Cardamine bellidifolia
" impatiens
Limosella aquatica
Thlaspi montana
Cheiranthus sinuatus
Arabis stricta
+Brassica muralis
Sisymbr. tenuifolium
+Brassica oleracea
Fumaria tenuifolia
" intermedia
Genista pilosa
Ulex nana
Lathyrus hirsutus
Vicia lutea
" hybrida
" bithynica
+Hippocrepis comosa
Trifolium ornithopodio[s]
" ochroleucum
" maritimum
" suffocatum
+Picris echioides
" hieracioides
Sonchus alpinus
+Lactuca Scariola
" saligna
Crepis biennis
Hypocharis maculata
Santolina maritima
Gnaphalium luteo-album
" gallicum
Erigeron canadense
Senecio squallida
+ " tenuifolia
Cineraria palustris
" integrifolia
Matricaria chamomilla
+Anthemis maritima
Centaurea Isnarda
+ " calcitrapa
Orchis militaris
+Cypripedium calceolus
and any other Orchidia
Carex digitata
" tomentosa
" divulsa
Xanthium strumarium
Ceratophyll[m] submersum
Hydrocharis morsus ranæ
Atriplex pedunculata
Asplen[m] lanceolatum
Polypodium cambricum
" arvonicum
" nigrum [?]
Scorzonera humilis
Daucus maritimus
+Ajuga alpina
+Bartsia alpina

John Mackay to N. J. Winch.

Dear Sir,—I ought long ago return[d] you my best thanks for your favour of Dec[r]. last, and the very acceptable present of dryed plants which accompanied it as also for yours of 27th Feb[r]. but I have been so very busy this spring I am sorry I have not been able to answer my correspondants in the manner

I could wish. I hope however you will not attribute my silence to want of Gratitude but be pleased to accept of my acknowledgements now though late.

I have now sent some of your Desiderata viz 50 specimens of plants and 30 Lichens which I am hopefull will give you pleasure, some of the specimens are not so good as I could wish, I shall be able to supply you with many live plants you want. Annexed is a list I have extracted from your specimens and Durham catalogue any of which will be very acceptable and I am much obliged by your giving me to hope for some of them I much want I should like them as soon as convenient sent by sea and carefully packed and put on Board just before the vessel sails, and advise me by post when shiped.

I have likewise given you a list of some of the rarer plants I have collected in Scotland, most of which I may be able to send you plants or specimens of I shall be extremely happy to see you here or to be of any service to you or our favourite science. I am with much goodwill,

Dr. Sir very respectfully,

Your most Obt Hble Servant

(Signed) JOHN MACKAY.

Botanic Garden,
Leith walk, March 21st, 1801.

[Addressed] N. J. Winch, Esqr.

Desiderata J. M.

+Carex species from Cronkley Fell
+Cistus marifolius
+Tamus communis
+Cypripedium calceolus
+Bartsia alpina
+Potentilla aurea
Malaxis paludosa
Hippocrepis comosa
Ophrys muscifera
+Gentiana verna
+Ribes petræum
+Euphorbia peplis
+Galeopsis Ladanum
+Senecio tenuifolius
+Anchusa officinalis
Sium latifolium
+Brassica muralis
Centaurea calcitrapa
Rottbolea incurvata
+Schœnus compressus
" albus
+Satyrium albidum
+Ornithogalum luteum
Polypodium rhæticum
Lepidium ruderale
Antirrhin^m Peloria
Orchis pyramidalis
" ustulata
Ophrys apifera
+Hottonia palustris
Atriplex pedunculata
" portulacoides
Bupleurum tenuiss^m
Rumex maritimus
+Juncus biglumis

+Euphorbia paralias
Cratægus aria
Thalictrum majus
Orobanche major
+Brassica oleracea
Trifolium hybridum
+ „ glomeratum
„ scabrum
„ ochroleucum
„ maritimum
Sisymbrium terrestre
+Euphorbia tithymaloides
+Chrysanth^m italicum
+Centaurea galactites
Medicago prostrata

Fucus natans
„ mamillaris
„ subfuscus
„ variabilis
Conferva spongiosa
„ elongata
„ pinnata
„ parasitica
Lichen jolithus
„ niger
„ flava virescens
„ Baeomyces

Lichen cœruleonigricans
„ sphærocephalus
„ punctatus
„ Dicksoni
„ tricolor
„ cerinus
„ upsaliensis
„ amphibius
„ granulatus
„ simplex
„ crenulatus
„ varius
„ subimbricatus
„ corneus
„ lacustris
„ crenularius
„ exanthematicus
„ ramosus et var.
„ leucophæus
„ Papillacea
„ musæcola
„ quernæus
„ sinuatus
„ inclusus
&c.
Anthemis maritimus
Aquilegia vulgaris wild

As under are some of the rarer Plants I have collected in Scotland :—

+Acer campestris
Acrosticum ilvense
+ „ septentrionale
+Adoxa moschatellina
+Anthemis arvensis
Tofieldia palustris
Arbutus alpina
+Arenaria tenuifolia
+ „ verna
+ „ marina, &c.
Asperugo procumbens
Asplenium ceterach
„ viride, &c.
+Astragalus uralensis
+ „ glyciphyllus
Azalia procumbens
Betula nana
Brassica campestris

+Campanula glomerata
Cardamine petræa, Light.
„ amœna
Carex extensa
„ filiformis
„ limosa
„ pauciflora
„ rigida
„ fulva
„ stricta
„ teretiuscula
„ pulla
„ lævigata
„ binervis
„ umbellatum
&c., &c., &c.
Centaurea scabiosa
Centunculus minimus

Cerastium latifolium
„ alpinum
\+ „ tetrandrum
„ arvense
Cherleria sedioides
\+Cicuta virosa
Cochlearia grœnlandica
\+ „ danica, &c.
Convallaria majalis
„ verticillata
Cotyledon umbilicus
Crithmum maritimum
Dianthus deltoides
Draba incana
„ hirta
Drosera longifolia
Dryas octopetala
Erigeron alpinum
Eriocaulon septangulare
Eriophorum alpinum
„ polystachion
Erysimum cheiranthoides
\+Euphorbia ezula
„ exigua
Galium 6 species
Genista anglica
„ tinctoria
Gentiana nivalis
\+Geranium pusillum
„ columbinum
&c.
\+Glaux maritima
Gnaphalium supinum
„ sylvaticum
„ rectum, &c.
\+Hieracium alpinum
„ molle
„ prenanthoides
„ Taraxaci
„ villosum
„ sylvaticum
&c.
Hypericum elodes
Jasione montana
Iberis nudicaulis
Inula crithmoides
„ dysenterica
Isoetes lacustris
\+Lactuca virosa
Lathyrus sylvestris
\+Ligusticum scoticum
Linnæa borealis
Lobelea dortmana
Lolium arvense
\+Lychnis viscaria
Myosotis nana
Œnanthe pimpinelloides
\+Ophioglossum vulgatum
\+Ophrys cordata
\+Orobus sylvaticus
Paris quadrifolia
Phleum alpinum
Pinguicula lusitanica
Poa alpina
„ cæsia
Polygonum minus
„ viviparum
Polypodium
Potentilla aurea
\+ „ verna
\+ „ argentea
&c.
Pulmonaria maritima
\+Pyrola minor
„ rotundifolia
„ secunda
„ uniflorus
Raphanus maritimus
\+Reseda lutea
Ranunculus reptans
„ hirsutus
„ lingua, &c.
Rubus saxatilis
„ chamæmorus
\+Sagina apetala
„ alpina
Salix herbacea
„ reticulata
„ retusa
„ arbuscula
„ lapponum
„ myrsinites
&c.
\+Samolus valerandi
Satyrium repens
„ albidum
\+ „ viride
Saxifraga nivalis
„ oppositifolia
„ cernua

Schœnus rufus
" compressus
" mariscus
&c.
Scilla bifolia, Light.
Scirpus pauciflorus
" multicaulis
Scutellaria minor
" galericulata
Serratula alpina
" tinctoria
Sibbaldia procumbens
Silene acaulis
" nutans
Smyrnium olusatrum
Sparganium natans
+Spergula subulata
" saginoides
Stellaria cerastioides
+Stellaria glauca
Subularia aquatica
Thalictrum alpinum
Thymus acinos
Tormentilla reptans
Trichomanes tunbridgen
Trientalis europæa
+Trifolium fragiferum
&c.
Turritis glabra
+ " hirsuta
Utricularia vulgaris
" minor
Veronica alpina
" humifusa
" saxatilis
&c.
Viola hirta

and all the other Plants in Flora Scotica, a dozen or two excepted.

Those marked thus + grow near Edinburgh.

John Mackay to N. J. Winch.

[May 27th, 1801.][1]

Dear Sir,—Your favours of the 1st April and 16th inst. I duely received and is sorry I have not had time to answer them sooner nor even now in the manner I could wish you may however rest assured it is not for want of good will—

I did not receive the Box of plants till the 24th of the month Gentiana verna is in life, but Cistus marifolius Sisymbrium tenuifolium Potentilla aurea and Anchusa officinalis are dead and should be thankfull for them again when you send me anything I should wish sent by the Mail Coach it was only on account of the Gentiana being in a pot I wish'd it by sea—I have not yet received the Lichens you are so good as allow me to hope for—

I shall be very happy to correspond with Mr. Harriman or to do any thing in favour of our favourite Science I now send a scroll of some of the Habitats of the rarer Scotch plants which I fear will scarcely read but as I hope to have the pleasure of seeing you here before you go to the Highlands and know the route you mean to take I shall be better able to point out what you may expect to meet with yr diffr. stages I hope I shall have time to show you what worth your nottice in this neighbourhood but cannot be above a day from home untill the Botanical

[1] In Mr. Winch's handwriting.

Lectures are over which is about the end of July—It would be a very good route for you I think if you do not mean to visit the N.E. part of Scot[d] to go by Perth, Dunkeld, Blair in Athol &c to Garvimore then by Pitmain to Inverness, from thence by Lochness to Fort Augustus Fort William Glenco Kings house &c to Tayndrum go forward by Killin to the mountains north of Loch Tay of which Ben Lawers is one of the best on that range of mountains you may find most of the rarer alpine plants—return again to Tayndrum and then to Inverary, Cavindon and E. Tarbet, to Luss, I will give you a letter to Dr. Stuart who will show you every thing worth your nottice there and perhaps accompany you to Ben Lomond from Luss by Dumbarton to Glasgow

This I think you might do in a month in a one Horse Chaise But it would be difficult to travel nearer the western coast any other way but on foot. The western part of the Island is perhaps best for Minoralogy though not for Botany. Arran affords the greatest variety of Fossiles as you may see by my friend Mr. Jamesons acct. with whom I travelled—I shall be able to send you many things you want, but must defur it till you return from the north when I hope to have more leisure. In the mean time

I remain, Dr. Sir, Your mo. obt. Hbl. St.

(Signed) JOHN MACKAY.

[Addressed] Nathl. Jno. Winch, Esqr.,
Spring Gardens,
New Castle.

[Enclosure.]

[1] Genista tinctoria, plentifully near Dumfries
Orobus sylvaticus, Braid hills 2 miles south of Ed.
Lathyrus sylvestris, St. Marys Isle
Vicia sylvatica, Salisbury Craigs
„ lathyroides, King's park
Ornithopus perpusillus, near the Maitland W. of Fisherrow
Astragalus hypoglottis, King's park Leith links &c.
„ glycyphyllus, Water of Leith N. Ferry
„ uralensis, N. Queensferry Ben Lawers sparingly

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

[1]Trifol[m] fragiferum, Leith links
Hypericum elodes, near Glenluce and other places in Galloway
„ humifusum, near Queens ferry
Hedypnois Taraxaci, Glen tilt
Hieracium alpinum, Ben Lawers Malghyr-dry &c.
„ sylvaticum, Ravelston woods
„ villosum, Ben Lawers
„ prenanthoides, near Pitmain
„ molle, King's seat, north of Forfar
„ umbellatum, Dunkeld &c.
Myosurus minimus, near Inverary
Serratula alpina, Ben Lomond &c.
Carduus pratensis, Methven woods near Perth
„ eriophorus, near Leith
Onopordon acanthium, Lime Kilns
Artemesia maritima, on the Coast in E. Lowthian Galloway &c.
Gnaphalium sylvaticum, Mountains N. of Loch Erroch Ben Wyvis in Ross-shire. Glen tilt north from Blair in Athol
„ supinum, Ben Lawers &c.
„ hyberboreum, Little Breeze hill Isle of Skye
Erigeron alpinum, Ben Lawers &c.
Aster tripolium, near Queens ferry &e.
Inula dysenterica, near Ely Fife and Castle of Dunskey Galloway
„ crithmoides, near the mull of Galloway
Anthemis nobilis, Leith links
„ arvensis, S. of Ed[r]. in diff. places
„ tinctorea, cultivated fields in Angus shire
Satyrium repens, woods at Brodie House
Pyrola rotundifolia, „ minor, „ secunda, „ uniflora — Near Brodie House and Darnway &c.
Ophrys nidus avis, near Taymouth &c.
„ corallorhiza, has been found by the side of Loch Ness I could never find where Light[foot] mentions Mr. Stuart of Luss informs me he only found one or two specimens which he gave Lightfoot.
Ophrys cordata, woods S. of Hopeton house Brodie house &c.
Serrapias palustris, below Kelso
Acrostisum ilvense, Ben Lawers and Craig Caillich
Asplenium ceterach, hill of Kinnoul
Carex pauciflora, N. from Blair &c.
„ rigida, „ pulla, — Ben Lawers
Saxifraga stellaris, „ nivalis, „ oppositifolia, „ aizoides, „ hypnoiddes, „ cernua — On Ben Lawers

[1] These names and localities are nat in table-form in the letter. They are so arranged here ror ease of reference.

[1]Dianthus deltoides, Arthur seat and other places near Ed.
Silene nutans, N. Queens ferry
„ maritima, } Ben
„ acaulis, } Lawers
Stellaria nemorum, woods at Roslin &c.
„ glauca, Loch end Dudingston Loch and near Edinr.
„ cerastoides, Ben Nivis
Arenaria verna, Arthur seat
„ tenuifolia, N. Queens-ferry &c.
Cherleria sedioides, Ben Lawers
Cotyledon umbilicus, Isle of Arran &c.
Sedum Telephium, N. Queens ferry and near Kirkaliston &c.
„ anglicum, common on the western coast
„ villosum, N. Queens ferry Pentland hills &c.
„ reflexum, Ravilston W. of Edr.
Cerastium tetrandrum, not uncommon on the coast of Fife and S. of Scotland
„ arvense, in pastures in Angusshire near Dirleton E. Lowthian
„ latifolium, } on Ben
„ alpinum, } Lawers
„ aquaticum, near Hopeton house
Spergula saginoides, Ben Lawers
„ subulata, N. Queens-ferry
Reseda lutea, near Lime-kilns, Fife
Euphorbia exigua, N. Queensferry
„ Ezula, Abercorn W. from Hopeton House
Sorbus hybrida, Isle of Arran
Rubus saxatillis, near Dun-keld &c.
„ chamæmorus, fre-quent in wet moor-ish places in the N. and S. of Scotd.
Potentilla aurea, E.B. Ben Lawers &c.
„ verna, Arthur Seat &c.
„ argentea, N. ferry
Tormentilla reptans, near Galloway house
Dryas octopetala, Glentilt N. from Blair, and plenti-fully in Strath Isle of Skye &c.
Thalictrum alpinum, in the Highlands frequent
„ minus, N. Queens ferry
„ flavum, near Hopeton house
Ranunculus Lingua, Loch end &c. near Edinr
Thymus acinos, near Nairn
Scutellaria minor, betwn Buchanan and Loch Lomond
Bartsia alpina, Malghyrdy in Breadalbane
„ viscosa, Gare Loch near Ardincaple in Argyleshire
Melampyrum pra-tense, } Den of
„ sylvaticum, } Rechip
Lathræa Squamaria, woods at Roslin

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

[1]Scrophularia aquatica, near Hopeton house
Linnæ[a] borealis, Edge of a fir wood near Inglismaldin near the roadside
Subularia aquatica, Loch Clunny E. from Dunkeld Loch Lomond &c.
Draba hirta, Ben Lawers
" incana, Ben Lawers
Alyssum sativum, corn-fields near Forfar
Lepidium latifolium, coast of Fife near Aberdour
Thlaspi campestre, near Hopeton house
" hirtum? near Duplin Perthshire
Cochlearia danica, N. Queens ferry
" groenlandicá, Ben Lawers
Iberis nudicaulis, near the Mull of Galloway &c.
Bunias Cakile, near Leith
Crambe maritima, western coast of So. of Scotd.
Cardamine amara, water of Leith
Sisymbrium monense, sandy shores in Arran Galloway &c.
Erysimum cheiranthoides, cultiv. fields in Arran &c.
Cardamine hastulata, E. B. in Skye
Turritis hirsuta, Arthur seat
" glabra, near Kinnaird
Brassica campestris, near Port Patrick in Arran Skye &c.
" Napus, Edinr. Castle rock—Inch Keith
Sinapis nigra, Inch Keith
Raphanis maritimus, Three miles from the point of the Mull of Galloway
Geranium columbinum, below Perth by the water side
Malva moschata, Hill of Kinnoul near Perth

Mr. Winch had come to Edinburgh on his tour through Scotland, and the following are letters of introduction from Mackay, along with a further instalment of his directions :—

John Mackay to N. J. Winch.

Dear Sir,—Inclosed are some letters for you which you will please seal before you deliver, they are wrote in a hurry but hope they will answer the purpose, I wish I had more time to make out a more explicit Route. With best wishes

I remain Dr. Sir Yours truely

(Signed) JOHN MACKAY.

B. G. 6 o'clock, Thursday.

Please be so good as give the bearer my parcel I will send for yours another time. J. M.

[Addressed]
Mr. Winch, Pool's Hotel.

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

John Mackay to George Houston, Paisley.

Sir,—Mr. Winch of New Castle being on a Tour through Scotland and having heard much of your Coal pits I have used the freedom of introducing to you if you will be so good point out what is most remarkable it will be highly gratifying

I hope your young trees are thriving

With my best Compts. to the young Gentlemen,

I am Sir Your most ob Servt.

(Signed) JOHN MACKAY.

Botanic Garden,
3 June 1801.

[Addressed] George Houston, Esqr., of Johnstone, By Paisley.

John Mackay to Mr. M'Combie, Inverness.

Sir,—The Bearer Mr. Winch of N. Castle being on a Botanical and Mineralogical Tour through the Highlands, I have used the freedom of Introducing to you. If you will be so good as point any thing remarkable in your neighbourhood it will be highly gratifying—Collector Ogilvie and Mr. Ar. Bruce desires to be remembered to you—The civilities you showed myself when I had the pleasure of waiting on you in Inverness, prevents my making any apology for troubling you at this time

I am Sir Your most Ob^{t}. Hb^{l}. Servt.

(Signed) JOHN MACKAY.

Botanic Garden,
Leith walk, June 3rd
1801.

[Addressed] Mr. M'Combie, Rector, Academy, Inverness.

[Enclosure marked "1st" in Mr. Winch's writing.]

[1]Salicornia herbacea, Inverkeithing bay
Hippuris vulgaris, Dudingston Loch near Edin[r].
Veronica saxatilis, Glen tilt, near Blair in Athol, Ben Lawers &c.
„ alpina, Mountains north from Loch Errich &c.
„ montana, near Edin.
„ anagallis, near Edin.
Pinguicula lussitanica, different places in ye Isle of Skye, Arran, and Lamlash
Lycopus europæus, not uncommon on ditch banks on ye western coast
Valeriana dioica, in ye South of Scotland and Berwickshire
Schœnus mariscus, near Forfar in Angus shire, and Kirkcudbright in ye S. of Scotland
„ compressus, ab[t] the caves on the coast East Dunbar
„ rufus, with the above and at Thornton Loch, &c.
„ nigricans, do.
„ albus, in many places in the north and west of Scotland
Scirpus multicaulis, in Skye, by ye side of the White Loch Manse of Colvend, and betw[n] Glen luce and the Mull of Galloway
„ pauciflorus, a common plant in many places as near Leith
Scirpus fluitans, two miles S. of Edr. &c.
„ maritimus, at Queensferry &c.
„ sylvaticus, woods at Roslin
Eriophorum polystachion, in Skye and other places in ye western Coast, woods of Colodon &c.
Phalaris arenaria, E. from Montrose
Phleum alpinum, Ben Lawers &c.
Poa alpina, Ben Lomond Ben Lawers &c.
„ cæsia, do.
„ flexuosa, Ben Nivis
Festuca calamaria, below the Lint Mill near the Public House foot of Ben Lawers
Lolium arvense, in corn fields
Rotbollia incurvata, near Hopeton house, and east from Dunbar
Elymus arenarius, E. from St. And[ws] at Irvin &c.
Scabiosa columbaria, near Arbroath
Galium Witheringii, n. of Forfar
„ saxatile, common
„ uliginosum, Bogs
„ palustre, ditches
„ mollugo, hills E. of Forfar
„ boreale, Roslin &c.
Plantago media, n. from Dalkeith
Centunculus minimus, difft. places around Forfar, Links of St. And[ws]
Sanguisorba officinale, S. of Scotland
Cornus suecica, Ben Lawers Benaglo Ben Lomond &c.

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

[1]Alchemilla alpina, common in ye North
Potamogeton graminum, } near
„ pusillum, } Forfar
„ lucens, }
„ compressum, E. from Forfar
„ pectinatum, Dudingston loch
Ruppia maritima, stagnant waters on the western coast &c.
Sagina apetala, North Queens ferry
Myosotis nana, on Ben Lawers
Asperugo procumbens, by the ruins of ye old church at Dunbar
Lysimachia vulgaris, by the side of Loch Lomond &c.
„ thyrsiflora, in a moss close to the town of Forfar and plentifully by the side of a Lake abt 4 miles E. of Forfar, &c.
„ numularia, woods at Bothwell Castle
Anagallis tenella, plentifully in ye south and west coast of Scotland, north fr. Haddington Tyningham sparingly in the Kings Park
Azalia procumbens, plentifully on the mountains, north from Blair in Athol—Ben Lawers and sparingly on Ben Lomond
Convolvulus Soldanella, plentifully on the Airsh. coast and S.W. coast of Galloway
Campanula latifol. } woods at
„ trachelium } Roslin
„ glomerata, betw[n] Kinghorn and Kirkaldy &c.
Jasione montana, plentifully in the S. of Scotland and near Hamilton
Lobelea Dortmana, in many of the Highland lakes and also in the S. of Scotland
Viola hirta, N. Queens ferry &c.
Samolus valerandi, Lord Elgin's Lime works Fife
Rhamnus frangula, below Dumfries
Glaux maritima, on the coast near Leith
Chenopodium maritimum, N. Queens ferry
Beta maritima, Bass Island and coast opposite
Salsola kali, near Leith
Gentiana nivalis, Ben Lawers S. side of the Loch
Ligusticum scoticum, Queens ferry
Sium angustifol[m], Kings park
„ nodiflo[m], below Kirkcudbright
„ repens, moist places in Guilan Links
„ verticillatum, plentifully in Galloway and Argyle shire near Loch Gare
Œnanthe pimpinelloides, E. from Dunbar Galloway Arran, &c.
Cicuta virosa, Loch End near Edin[r].
Smyrnium olusatrum, E. from Wemyss Castle fife

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

[1]Apium graveolens, Back of Loretto Musselburgh &c.
Sambucus Ebulus, 2 miles S. of Ed. and on the coast of Fife
Statice Limonium, St. Marys Isle
Sibbaldia procumbens, frequent in the Highlands
Drosera longifolia, head of Loch Erroch and on the western coast &c.
Tulipa sylvestris, near Brichan
Scilla bifolia, Light. on the Galloway coast
Convallaria verticillata, den of Rechip E. from Dunkeld
„ majalis, do.
Juncus acutus, near Colvend Galloway
„ maritimus, E. from St. And^ws. Galloway coast and Isle of Arran
„ trifidus, north from Blair in Athol Ben Lawers
„ triglumis, Ben Lawers
Juncus biglumis, } Ben
„ spicatus, } Lawers
„ castaneus, }
„ bulbosus, near Leith
„ uliginosus, near Forfar &c.
Rumex digynis, in the north
Tofieldia palustris, north from Blair Ben Lawers &c.
Triglochin maritimum, Queensferry
Alisma ranunculoides, Kings park
Epilobium roseum, Ben Lawers &c.
„ alpinum, do.
Daphne Laureola, woods at Roslin
Polygonum minus, Ayr links, and S. from Forfar
„ bistorta, in the Highlands frequent
Paris quadrifolia, Den of Rechip
Andromeda polifolia, below Dumfries
Arbutus alpina, S. of Garvimore plentifully in Rossshire near Loch Broom

[Enclosure marked "2" in Mr. Winch's writing.]

Abt a mile sth of Garvimore, on the N.W. side of the Hill +Arbutus alpina—about three miles W. of Pitmain by the road side, Hieracium prenanthoides and Satyrium albidum

The vitrified rock of Craig Phaedrech, abt two miles W. of Inverness on the road to Beaullie.

On the banks N. side of Loch Ness++Ophrys corallorhiza has been found and Rubus Nessensis.

On Ben Nivis++Salix myrtilloides Stellaria cerastoides++++ Poa flexuosa Saxifraga rivularis++Ajuga pyramidalis Hieracium villosum &c.

Mr. Stuart will show everything remarkable about Luss and Ben Lomond &c.

To go from Tayndrum by Killin to Croft house where you ascend Ben Lawers to proceed by the rivulet that leads from the Loch about half way up the hill before you come to the Loch you will

[1] These names and localities are not in table-form in the letter. They are so arranged here for ease of reference.

observe Juncus triglumis biglumis and castaneus on the dry summit J. trifidus on the rocks N. of the Gentiana nivalis, Acrosticum ilvense, Veronica saxatilis, and sparingly Astragalus uralensis.

++Saxifraga cernua near the summit of the Hill and an++ Arenaria in habit something like Cherleria sedioides Cerastium latifolium and alpinum++Erigeron alpinum+Carex pulla Carex atrata C rigida Salix reticulata and herbacea arbusc[ul]a in various parts of the hill, as well some of those mentioned formerly Epilobium alpinum in the rivulet Cornus suecica Black peat earth Draba incana and hirta Viola with blue flowers Myosotis nana Azalia procumbens and most other alpine plants; below the Lint Mill a little to the So. of Croft house, where you ascend the hill, Festuca calamaria ab^{t} 3 miles from Kenmore betw^{n} the road and the Loch Osmunda regalis, it is very common at Luss—Bartsia viscosa by the side of Gare Loch near Ardincaple; Sium verticillatum very common in that neighbourhood in moist meadows—

The Pre....[1] at Fintray, 2 miles from Dumbarton, on the road to Glasgow.

(here I must stop)

Acer campestre on the banks a little to the east of N. Ferry—Astragalus uralensis, top of the banks a little further on.—Silene nutans a little below that and more to the east amongst the rocks. Cochlearia danica by the dyke at the east landing near the Fort. Spergula subulata and Arenaria tenuifolia, &c., between the Fort and the Town—Ligusticum scoticum on the coast a little to the west of the N. Ferry—Carex teretiuscula in a marsh top of the hill betwn the Ferry and Inverkeithing—Ranunculus reptans side of Loch Leven, near Kinross.

On the hill of Kinnoul Asplenium ceterach Cynoglossum officinale Sagina apetala Potentilla argentea &c. Ranunculus hirsutis a little west of Perth.

Convallaria verticillata Melampyrum sylvaticum and pratense, Salix caprea Convallaria majalis &c., in the Den Rechip East from Dunkeld.—Subularia aquatica, Isoetes lacustris, &c., in the Loch of the Lows S.E. from Rechip++Lycopodium inundatum between that and Clunny; if you find time go the length of Clunny which is abt 5 or 6 miles E. of Dunkeld Mr. M'Ritchie[2] will point out all the rare plants in this Parish—

[1] Illegible.

[2] The Rev. William MacRitchie was born in the parish of Clunie, Perthshire, in 1754. From 1783 to 1837 was minister of Clunie, where he died 6th December 1837. For biographical details see his "Diary of a Tour through Great Britain in 1795," edited, with an Introduction and Notes, by David MacRitchie. London, 1897.—*I. B. B.*

Mr. Peter MacIntosh the Gardiner at Blair will show you through the Dins where you may observe++Pyrola secunda Aspl viride and other rare plants He may also direct you to Bennaglo and Glentilt where the Azalia procumbens grows in the greatest abundance as also Gnaphalium sylvaticum Cornus suecica, Veronica saxatilis Polygonum viviparum+Toefieldia palustris++Carex pauciflora Gentiana amarella and campestris Carex capillaris Juncus trifidus Dryas octopetala

South from Dalwhinnie between that and the head of Loch Erroch, the++Carex pauciflora in plenty and which I much want, +Drosera longifolia on the hills to the N. of the Loch+Veronica alpina + + Gnaphalium + sylvaticum + Lycopodium annotinum Betula nana &c.

I do not attempt an analysis of Mackay's botanical work. Our record of what he did betokens a vast deal of work regarding which we have no information. In the short span of his life he advanced materially the knowledge of the plants of Scotland and is entitled to rank with George Don as an investigator of its flora. If he is less known than his compatriot we may find the reason in his early death and in the eclipse of his reputation by that of Don around whose name have circled so many controversies which are referred to below. The relative merits of the two botanists do not call for discussion by me here. The men were a remarkable couple of enthusiasts—one of finer, the other of rougher fibre—firm friends to the end of the days of the younger. The preceding pages will furnish botanists with such data as are available for an estimate of Mackay's character and life-work, as the succeeding pages will provide similar data in regard to George Don. The only further comment I could make is that all the evidence we possess goes to show that John Mackay was no less gifted than his brother, James Townsend Mackay, and by his death Scotland lost a field-botanist who might in the end have dealt with its flora in the comprehensive and thorough manner in which his brother treated that of Ireland.

George Don.

Although John Mackay died in April 1802, some time elapsed before his successor was appointed, or at least entered upon

his duties. This successor was George Don, who is known to posterity, not for his work as Principal Gardener of the Botanic Garden, where his career was not a long one, but as a botanist of acute perception and as an able investigator of the Scottish Flora. The friendship between Mackay and Don, which brought Don to Edinburgh and to the Botanic Garden to visit him, would furnish opportunity to Professor Rutherford of becoming acquainted with Don, and of realising the great knowledge of British plants he possessed and his practical acquaintance with gardening, and these would be strong recommendations in favour of his selection for the post of Principal Gardener when it became vacant. As matter of fact, Don did not enter upon the duties of Principal Gardener until mid-December of 1802, and it was only on 24th October of that year that Brodie of Brodie, who interested himself in Don's appointment, wrote to Sir James E. Smith telling him of it. Even allowing for some delay after the event in the penning of this letter, there must have been a considerable interval between Mackay's death and Don's appointment. Why was this? In the light of after-history may we not construct a picture of, on one side, Rutherford, tempted by Don's qualifications as a botanist and gardener, yet hesitating to appoint one whose independence and wilfulness, showing, as one must believe, in Don's every feature and action, gave scarce promise of contentment under control; and, on the other side, Don, wrestling with himself over the value of his freedom and doubtful of the wisdom of entangling himself in the trammels of the routine of a subordinate and ill-paid official post which would enforce banishment from the open-air life amongst the plants on the hills to which he had become used. Whether this be right or wrong, certain is it that Don's advent as Principal Gardener was long delayed, and it is significant that when he did come to Edinburgh he did not give up his Forfar garden. That, as we are told, he left under the care of his father and to it he returned when, whatever the cause or causes, he quitted the Botanic Garden after some three or four years' service in it.

I had accumulated with other material for a History of the Royal Botanic Garden some facts for a memoir of George Don, when I heard from Mr. G. Claridge Druce that, following

upon his Presidential Address to the British Pharmaceutical Conference, in which he had given a biographical sketch of Don, he had worked out in critical detail the story of Don's botanical work, and of the discoveries of British plants with which Don's name has been associated. Mr. Druce was so good as willingly to assent to his memoir of Don and analytical account of Don's work appearing in "Notes from the Royal Botanic Garden, Edinburgh," as part of our History, as it does in the following pages. Here and there his story has been modified, with his consent, in the light of facts not in his possession at the moment of writing, and other information has been introduced in footnotes. It will be seen that I am much indebted to Mr. Alexander P. Stevenson of Dundee for new matter included in footnotes, and I have to thank him for the postscript regarding the progress of the movement for the erection of a monument in Forfar to the memory of Don ; he also first directed my attention to the paper on "Indigenous Grasses" by Don in the Transactions of the Highland Society of Scotland. This paper, and also Don's account of "Native Plants of Forfarshire," are reprinted as appendices to Mr. Druce's Memoir. In both of them there is mention of dates of incidents in Don's life, and the first is prefaced by a brief autobiographical statement. Another Appendix contains, by permission, such of George Don's letters as have come under notice, my object being to present all the evidence available for independent judgment upon the questions that have been raised in regard to Don and his work and his relations with contemporary botanists. It is much to be regretted that Dr. Neill, who knew Don so well, did not write a biographical notice of him early in the century, at the time of Don's death, when the incidents of Don's life would be fresh in his mind ; and it is no less regrettable that Dr. Neill's papers, which were in existence in Edinburgh up to a few years ago, have disappeared and cannot now be traced, for amongst them, doubtless, there will be correspondence with Don. Should these papers be found and given to the public they may be expected to throw much light not only on Don's history but also upon all the leading botanical events that happened in Scotland during the first half of the nineteenth century. As it is, we have but little material relating to the early years of Don's

life, and the story of them as given by Mr. Druce is somewhat conjectural and open to correction.

A special interest attaches to Don's life that is absent in the case of other Principal Gardeners on account of the number of plants new to the Scottish Flora that were recorded by him and which were for long gathered by no one else. The list of such "unconfirmed finds" is smaller now than it was a few years ago. In the case of some of them it seemed unlikely that the plants would belong to the Scottish Flora, and as year after year passed by without their being re-gathered the question of the possibility of error on Don's part was naturally raised and discussed with increasing persistency. In the following pages Mr. Druce deals with this matter in fullest detail.[1] I wish only to say here regarding it that as I read history it does not seem to be established that botanists of last century suggested—as has been hinted—moral turpitude on the part of Don—that he deliberately recorded false stations and knowingly sent out garden-plants as natives of the Highland hills—but only that his methods and circumstances[2] being such as to make mistakes easy and not unlikely, he sometimes fell into error. If an incautious botanist occasionally expressed himself in too dogmatic terms regarding Don the attitude of the majority has been, I think, the judicial one so clearly explained by Mr. H. C. Watson[3], and in Scotland there has been coupled with this an expectancy, as stated by Professor John Hutton Balfour[4], although with often a reservation in respect of some unlikely forms. So much was the just claim of Science, and the list of "Reputed" and "Unconfirmed" Discoveries by Don that is placed at the end of "Hooker's Student's Flora" was its legitimate outcome and a call to investigation. That investigation has resulted—as Mr. Druce shows, and in it he has shared in no small degree—in a reduction of the dimensions of the list, but, notwithstanding all that has been done, we have still, nearly one hundred years after Don's time, a list of plants recorded by him "respecting which grave suspicion of error exists."[5]

[1] See pages 123, 141.

[2] See Mr. Druce as to this on page 142.

[3] Quoted with approval by Mr. Druce on page 93.

[4] "Botanical Excursions made by Professor John Hutton Balfour," in Notes from the Royal Botanic Garden, Edinburgh, vol. ii. (1902), p. 55.

[5] See Mr. Druce as to this on page 125.

The Life and Work of George Don.

BY

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[Notes, R.B.G., Edin., No. XII., 1904.]

PREFACE.

IN compiling this Memoir of George Don I have to make acknowledgments to Mr. John Knox for his kindness in lending me the Herbarium and Fasciculi of Don's plants, to the authorities of the Linnean Society and British Museum for allowing me to consult their collections, and to Miss Palmer for copying out the labels on the plants of Don which are in her collection and which I have carefully examined.

When I gave a short sketch of the progress of Scottish Botany as my presidential address to the Pharmaceutical Conference at Dundee in 1902, I included necessarily an account of the work of George Don. This drew some attention to the subject of the Memoir, and an appreciative special article which appeared in the *Scotsman* gave wider publicity to the subject. When the local Committee of my meeting at Dundee made up their accounts they found a balance on the right side, and it was determined to subscribe a sum of five pounds for the purpose of starting a fund towards erecting some simple monument to George Don in his native town. Later on I was requested to help in the matter, and I accordingly issued an appeal to the readers of the *Pharmaceutical Journal*, *Chemist and Druggist*, *Gardeners' Chronicle*, *The Journal of Botany*, *Annals of Scottish Natural History*, and the *Scotsman*, which has met with an adequate response. Meanwhile Mr. John Knox and other Forfarians have also been stirring, and our united efforts will be sufficient to remove the reproach of allowing Don to rest in a nameless grave.

To Professor Bayley Balfour I am especially indebted for assistance, not only with regard to the memorial, but for allowing this Memoir, to which he has added, to be issued under the ægis of the Royal Botanic Garden at Edinburgh.

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Memoir.

George Don was born on the Farm of Ireland in the parish of Menmuir,[1] in Forfarshire, and was christened on October 11th, 1764, his parents being Alexander Don (1717-1813) and Isobel Fairweather ; both parents were descended from respectable farmers in the parish, and his father, as was not uncommon at that period, also carried on the trade of a currier, which he followed on his removal to Forfar, about the year 1772. The name Don as a patronymic means the brown-haired or brown-complexioned individual, being therefore synonymic with that of Brown.

George Don received at Forfar the ordinary elementary education at the parish school. He had a natural turn for mechanics, and acquired a taste for reading and observation, but his real education was obtained in the open air, wandering in the fields or by the loch side, and from his boyish days he took delight in noticing the minute characters of such birds, insects,

[1] The foundation of this memoir is the story of Don's life given by Mr. J. Knox in the Scottish Naturalist, 1883-84. I learn through Mr. Druce that Mr. Knox is not assured of the accuracy of many of the details he gives of Don's early life. Mr. A. P. Stevenson of Dundee tells me that there is still some doubt as to Don's birthplace. The certificate upon which Mr. Knox relied may not really refer to the botanist, George Don, and it is suggested the date of his birth must be earlier than 1764. Certainly the story as given of his early life supports such a suspicion, for it says that he was a gardener at Dupplin in 1779 when he would be fifteen years old, yet previously to this he had gone through an apprenticeship to a clock-maker in Dunblane and subsequently as a journeyman had worked in Glasgow. Mr. Stevenson points out also that Don speaks in "Headrick's Forfarshire" (see Appendix F to this Memoir, p. 235) of seeing a peregrine falcon "in the possession of the Laird of Balnamoon's grandfather, and of his servants hunting with it about the year 1771." Don would, if born in 1764, be then seven years old and might well remember. Balnamoon too is, he says, an estate in the parish of Menmuir, and this would support Mr. Knox's statement as to the birthplace.—*I. B. B.*

and plants as came within his reach. He wrote a bold hand, and his style was clear and vigorous. He was apprenticed to a clockmaker in the town of Dunblane, and there formed his first "hortus siccus," consisting of all the flowering plants and mosses which he could collect in the neighbourhood. Unfortunately no trace of it is now extant. In the "Hortus Britannicus," which he afterwards issued, he refers to some of the plants of the neighbourhood, for instance to *Scolopendrium*, No. 143, which came from a well at Dunblane.

When he became a journeyman he removed to Glasgow,[1] and

[1] Gardiner, "Flora of Forfarshire," 1848, Introduction, p. xii, says, without giving date :—"While in this city [Glasgow] his unbounded love for botanical pursuits began to show itself so prominently that he obtained the situation of Assistant to the Professor of Botany in the University. . . . After remaining for some time in this place he went to Edinburgh, where he soon became acquainted with the Messrs. Dicksons, and these gentlemen introduced him to the notice of other votaries of the science, both Scotch and English, more particularly to Sir J. E. Smith, the President of the Linnean Society, who took a great interest in him, and warmly patronised his efforts to extend the knowledge of British Botany."

Mr. A. P. Stevenson of Dundee writes to me :—"Gardiner had no knowledge of Don directly, of course—he was born after Don's death; but his uncle, Douglas Gardiner, who is referred to in the Flora of Forfarshire, p. 61, 'as an intimate friend of Don,' would know something of Don's personal history and would not fail to tell his nephew. In one of Gardiner's MS. magazines he says Douglas Gardiner had promised to contribute some biographical notices ; but unfortunately they never appeared."

As the Chair of Botany was not established in Glasgow until 1818 I applied to my friend Dr. Bower, Regius Professor of Botany in the University there, for information that might elucidate Gardiner's statement regarding Don's Assistantship, and he has been so good as to procure for me the following Notes bearing upon this question, which have been prepared by Mr. James Coutts, Assistant Clerk of Senate, University of Glasgow. They are an interesting contribution to the history of Botany in Scotland.

"NOTES ON TEACHING OF BOTANY IN UNIVERSITY OF GLASGOW FROM ABOUT 1779 TILL FOUNDATION OF CHAIR OF BOTANY IN 1818.

"There is no mention in the minutes of a lecturer on Botany at Glasgow University about 1780 to 1790, and the references which occur to the subject of Botany would not lead one to infer that there was such a lecturer. The Professor of Anatomy was also Professor of Botany till a separate chair in the latter subject was founded in 1818.

"In 1779 towards the end of Thomas Hamilton's professorship, when his health was impaired, Dr. William Irvine, then Lecturer on Chemistry and

there he generally worked about five days a week at his business, devoting the rest to botanical exploration, thus being enabled to penetrate into the Highlands as far as to Ben Lomond. During the period of residence in Glasgow he noticed *Lythrum Salicaria* and *Lycopus europæus* near Paisley, and *Scirpus maritimus* near Dumbarton.

He afterwards went to Dupplin Gardens, where a relative was in charge, and there he remained during several years and received his training as a gardener, using his scanty leisure to explore the Ochils, and even the spurs of the Grampians, thus obtaining a good knowledge of the Scottish flora. When at

Materia Medica, wished to teach Botany as well. Hamilton objected, and the Faculty of the College, after hearing statements from both sides, declared that no one connected with the College had a right to teach Botany without Hamilton's permission and appointment; and that, if a Professor did not teach or name a substitute to teach for him, the Faculty had a right to oblige him to adopt one or other alternative, failing which, the Faculty had a right to appoint a substitute. A few days later the Faculty added a further deliverance that no Professor, when unable to teach himself, had a right to appoint a substitute without their consent.

"William Hamilton was Professor of Botany and Anatomy from 1781 to 1790. The minutes show that he was specially careful about the Botanic Garden, taking pains to obtain a good gardener, and procuring allowances from time to time for manure, loam, plants, tools, &c. He also had a hothouse of his own in the Garden. There is no mention of his having any teaching assistant. Looking to the declaration of 1779 that the consent of the Faculty was necessary to the appointment of a substitute, and to the fact that when a substitute was appointed in 1799 the transaction was duly minuted, it would seem that the Professor must have been in charge of the Botany class in William Hamilton's time, though it is conceivable that he might have had a private assistant for subordinate duties.

"James Jeffray became Professor of Anatomy and Botany in 1790, and his catalogues of the Botany class from 1791 to 1798 are still extant. In 1799 Thomas Brown[1] (M.D. Edin. 1798) [referred to by Dr. J. E. Smith in English Botany under Valeriana pyrenaica, plate 1591, as Dr. Brown, Lecturer on Botany in the University of Glasgow] was, on the recommendation of Jeffray, allowed to conduct the Botany class. Next year Jeffray was allowed to employ Brown to teach Botany so long as it should be expedient. On a representation made by Brown in 1804, orders were given for the payment of an annual allowance of £5 in use to be made for manure, seeds, &c., for the Botanic Garden. About 1808 Brown seems to have ceased teaching In 1809 an allowance of £20 was made to Jeffray for plants

[1] Brown married Marion, sister of Jeffrey of the Edinburgh Review.

Dupplin, in the late part of the year 1779, he discovered a very small species of moss, which in 1806 was figured in English Botany,[1] and described by Sir James E. Smith, in English Botany t. 1582, as *Gymnostomum Donnianum*, and which is now known as *Anodus Donianus*. As showing how keen his memory was, we may cite the statement he makes with regard to this moss in 1806,[1] "that he had not been able to visit the spot so late in the year (as it is in fruit in December), but that on his return from visiting Ben Lawers in 1804 (twenty-five years after his discovery of it), he 'pointed out the rock on which it grew to his friends, the Millers, and desired that pieces of the rock might be sent him at various seasons,' and thus he was enabled to supply the fruiting specimens for his 'Herbarium Britannicum.'" The moss is extremely small, and probably no trace of it was visible in the autumn when he pointed out the locality to his friends. When he was at Dupplin he also discovered the leopard's-bane, *Doronicum Pardalianches*, which still occurs in the original locality. During his residence at Dupplin, on one of his botanical rambles he met Caroline Stewart, related to the Oliphants of Gask, and, helping her with the load she carried, began an acquaintance with the active, energetic woman to whom he is said to have been married in 1789.[2]

for the Botany class. Probably this was about the time when the College Botanic Garden, which had an area of almost three roods, was discontinued. The allowance of £20 for plants was continued to Jeffray till 1815. In 1816 the Faculty agreed to Jeffray appointing Robert Graham (M.D. Edin. 1808) to teach the Botany class, the allowance for plants being voted to Jeffray. In 1817 the Faculty renewed their consent to Jeffray's employing Graham to teach Botany, and this time the allowance of £20 was made to Graham. In 1817 the Faculty agreed to subscribe £2000 for the Royal Botanic Garden, and next year Graham was made regius Professor of Botany.

"The lectureship on Botany as held by Brown and Graham was not on the same footing as the lectureships on Chemistry, Materia Medica, and Midwifery. The lecturers on these three subjects were appointed directly by the University authorities, and each had a salary from the University. The lecturer on Botany was the nominee of the Professor of Anatomy and Botany, and though his appointment was sanctioned by the academic authorities, he had no salary from them."—*I. B. B.*

[1] Don. Herb. Brit., No. 145. See p. 168 of these "Notes."

[2] "Genealogy of the Don Family." By Surgeon-General Don. London, 1897. It is also there stated that the eldest child was born in 1794.

On leaving Dupplin he went southwards, living some time in Worcestershire, probably as gardener to Lord Plymouth at his seat of Hewell Hall, as under *Geranium columbinum*, in his "Herbarium Britannicum," he says he observed it "in cornfields near the seat of Lord Plymouth." From this neighbourhood he also records several other plants for the first time for that county, including the hart's tongue fern, *Phyllitis Scolopendrium*, the gipsy-wort, *Lycopus europæus*; the water chick-weed, *Stellaria aquatica*; and the procumbent cinquefoil, *Potentilla procumbens*; and in cornfields near Redditch in 1784, for the first time as a British plant, *Galium spurium*, but this only as a casual, not a native, species. Don also noticed two or three plants such as *Stellaria aquatica*, and records them for the first time for Warwickshire.

Probably on his return Don passed Oxford, as he says he saw the Oxford ragwort, *Senecio squalidus*, in the neighbourhood of that classic city.

He spent also about six months at Broadworth, five miles from Doncaster[1], and records several species, including *Teesdalia nudicaulis* and *Cerastium arvense*, from that neighbourhood, but all these had been previously published when he issued his "Herbarium Britannicum," 1804-12.

In the early part of 1789 he was in London,[2] probably employed in one of the nurseries, for he remarks of *Matricaria Chamomilla* (Herb. Brit., No. 118), "I observed this plant as a common weed in nurseries and gardens near London, particularly on the Surry side," and he refers to having seen *Lythrum Salicaria* (Herb. Brit., No. 164) near London, and under *Potentilla opaca* (Herb. Brit., No. 165), he says the *P. opaca* of English authors appears to be the *P. verna*; at least such was the case with the plant cultivated in Mr. Curtis' garden at Lambeth Marsh. He also says he has seen *Campanula Rapunculus* by the sides of hedges near Millbank, but it appeared hardly indigenous, and in his herbarium there is a specimen of *Briza maxima* from Newington Butts, but of course only as an escape from cultivation.

[1] "I lived in Yorkshire half a year at Broadworth, near Doncaster."—*Winch Corresp. Linn. Soc.; G. Don to Mr. N. J. Winch, May 11th, 1802.—I. B. B.*

[2] Don says "When I was in London, about the year 1786." See p. 199 of these "Notes."—*I. B. B.*

He afterwards settled at Forfar, and with the small sum of money he and his wife had saved leased in 1797 for a term of 99 years at a low rent, from Mr. Charles Gray of Carse, two acres of land on the condition that he should build a cottage of certain dimensions within a limited period.[1] This piece of ground, which

[1] By the courtesy of Mr. A. P. Stevenson of Dundee I am permitted to quote the following from a letter to him, dated 5th May, 1904, of Mr. A. M'Hardy, Town Clerk of Forfar :—

"On making a search in the Town's Repositories I have been fortunate in finding the titles of Don's Gardens, called the Dovehillock. These consist of :

"1. A Tack or Lease granted by Charles Gray, Esq. of Carse, to George Don, Merchant and Botanist in Forfar, of one acre of land lying on the east end of the Dovehillock, part of the Farm of Turfbeg on the entailed Estate of Carse Gray in the Parish of Forfar, dated and subscribed by both parties at Carse the 5th October 1797. The Lease is for a period of ninety-nine years from Whitsunday 1797 at the yearly rent of 5/- and on the condition in terms of the Act of Parliament that the tenant should build two dwelling-houses thereon.

"2. Assignation and Conveyance by George Don, residing at the Botanic Garden, near Forfar, oldest son and heir of the deceased George Don, Botanist at said Botanic Garden, with consent of William Roberts, Writer in Forfar, Curator nominated and appointed to him by the Sheriff in favour of James Webster, Bank Accountant, and Charles Rodger, Writer in Forfar, as Trustees for behoof of the Grantor's father's Creditors, of the Lease of ground dated 15th June 1815. This Deed was granted in respect that the said George Don (the Botanist), who died 15th January 1814, left his affairs in an embarrassed state and was unable to pay his debts and on condition of the heir and his brother, David Don, and his mother, Carolina Stewart, Relict of George Don the Botanist, being freed and relieved of all claims connected with the Deceased's affairs. It also conveys the acre of ground and dwelling-houses built thereon for the remainder of the Lease.

"3. Articles of Roup of the said Lease and Minute of Purchase thereof in 1818. This minute bears that George Webster, Merchant in Forfar, purchased the Lease at £100 sterling and passed it over to the said William Roberts—which seems a questionable transaction.

"4. Translation by Charles Rodger, only surviving Trustee for the Creditors of George Don, Botanist, in favour of William Roberts, Writer, Forfar, dated 2nd November 1819.

"5. Assignation (following on a Roup) by the Trustees of the said William Roberts in favour of Alexander Whyte, Blackburn, near Downie Park, of the said acre of ground with the houses built thereon at £182 dated 21st September 1827. (*Note.*—I may mention that I personally remember of this Alexander Whyte, who resided latterly and died at Careston, but who never occupied Dovehillock.)

was called Dovehillock (vulg. Doo Hillock), sloped to the west into what at one time had been Forfar Loch. He lived here in a very penurious and frugal manner, selling vegetables to such of the Forfar people as chose to send for them. He made a large artificial pond, which he stocked with aquatic plants and fish, leaving room for a broad border, in which the native plants were arranged according to the Linnean system and grown in their appropriate soils. In addition, he rented several acres of land as a nursery for young trees.

About this time he was particularly eager in exploring the Highlands, and not the least interesting of his discoveries is that of the beautiful district of Clova, which he first made known to the botanist. He occasionally absented himself for a week at a time, his plaid, and a bag of oatmeal or some bread and cheese, sufficing him for shelter and sustenance; and he lost count of the days in these toilsome expeditions, so that, it is said, he once presented himself at the manse of St. Vigeans laden with specimens on a Sabbath morning as the occupants were going to

"6. Assignation and Renunciation by the said Alexander Whyte in favour of the Magistrates and Town Council of the Burgh of Forfar dated 25th May 1858.

"I may add that a few years prior to the date of the last Deed the Town Council had acquired the *property* of Dovehillock and some adjoining ground by excambion from Carse Gray, so that in 1858 the Town became absolute proprietors of the property and lease.

"I think the above is the whole information that it is possible for me to obtain, and I trust it will be of some service. At least it is absolutely reliable."

Dr. Neill, in his Memoir of John Mackay, says (see page 23 of these "Notes") that Don was a clock and watch maker in Glasgow in the summer of 1793, and in the summer of 1794 Forfar had "become the place of his residence and where he cultivated an immense variety of the rarest hardy plants." This, on the face of it, seems unlikely unless perhaps the plants had previously been under the care of his father, who is said to have been a great cultivator of flowers; and I am inclined to the view that Don was at Forfar earlier than Dr. Neill suggests. Don himself says, "I have cultivated [Poa glauca] at Forfar since the year 1793." (See p. 196 of these "Notes.") It is clear that Don had a garden at Forfar before he went to Dovehillock. When writing in 1805 Don says, "I afterwards had occasion to remove my collection of living plants to a piece of ground near the town of Forfar." (See p. 195 of these "Notes.") He refers in this to the move to Dovehillock in 1797, but we have no indication of the whereabouts of the garden *at Forfar* in which he was growing plants from the year 1793 onward.—*I. B. B.*

kirk. There he met his friend the minister, and asked him, "What day is't—Fast or Sabbath?" He got his answer, and replied, "Man, I have lost count, but if I had my hands and face washed I would gang to the kirk too." He was shown to a bedroom for this purpose, but when Mr. Muir, the minister, went to call him he found him fast asleep.

Dr. Patrick Neill of Canonmills Lodge, Edinburgh, who in after life proved a kind friend to Don, and a generous and timely helper to his widow and children when they sorely needed it, gives the following account[1] of how he made Don's acquaintance:—

"When on a pedestrian excursion along the east coast of Scotland I happened to spend a night at Montrose, and it occurred to me that both Brechin and Forfar deserved to be visited—the former for its well-known Den Noran and its round tower of remote antiquity; and the latter for its remarkable botanic garden, and its owner, whose fame was familiar to me, owing to my intimacy with his regular correspondent, Mr. John Mackay of the Leith Walk Nurseries.[2] In passing along the margin of the sea basin above Montrose, the tide being at ebb,

[1] Biographical notice of the late Mr. George Don of Forfar. By Pat. Neill, LL.D. "Transactions of the Botanical Society of Edinburgh," Vol. IV. (1850-53), p. 117. Published also in the "North British Agriculturist" for the year 1851, and in Henfrey's "Botanical Gazette," Vol. III. (1851). It is remarkable that Dr. Neill, possessing as he did an intimate first hand knowledge of George Don and his life-work and endowed with a prolific pen, should not before the date of this notice, thirty-seven years after Don's death, have written a memoir of him as he had done in the case of John Mackay. Its belated appearance gives to the notice more the character of a recollection than of a record. Previous to Dr. Neill's notice Gardiner had given in 1848 a short account of George Don in his "Flora of Forfarshire," and this was apparently the first published account of Don. It appeared in the end of 1847, although the date on the title page is 1848—so Mr. A. P. Stevenson informs me.—*I. B. B.*

[2] Mackay held a responsible post in these nurseries from 1792-1800. According to Dr. Neill in his memoir of Mackay, Don and Mackay became personally acquainted in 1793 at Glasgow; Don, however, puts the date as 1791 (see Appendix G, Letter to Mr. Winch, January 1804). If Don's garden referred to by Dr. Neill is Dovehillock then this visit of Neill to Don cannot have been earlier than 1797. This date is also pointed to by the number of Don's family mentioned by Dr. Neill, the eldest of whom was born in 1794, according to Surgeon-General Don.—*I. B. B.*

I picked up some fine plants of *Salicornia herbacea*, then in flower, and also a somewhat shrubby variety. On reaching Forfar towards evening I soon found Don's garden, and entering inquired of a very rough-looking person with a spade in his hand, whom I took for a workman, whether Mr. Don was at home. The answer was, 'Why, sir, I am all that you will get for him.' Having apologised in the best way I could, I stated that when I left home I did not anticipate a visit to Forfar, else I could have brought a note of introduction from Mr. John Mackay. Mr. Don, pointing to my botanical box, immediately said, 'That is introduction enough to me'; and, having inspected the contents, remarked that he was in want of an example of *Monandria Monogynia*, an *Equisetum* not having succeeded, forthwith conducted me to the Linnean arrangement. I was then introduced to Caroline, his wife, who had brought him two sons and a daughter. I persuaded him to accompany me to the inn at Forfar, where he spent the evening with me. Next morning at six he met me there by appointment, and conducted me to Restennet Moss, where I had the great satisfaction of procuring a living patch of *Eriophorum alpinum* and a number of fine specimens for drying. The Moss was at this time partially drained for the sake of a rich deposit of marl, but at one end there was still sufficient marsh for the growth of *Schœnus* (*Cladium*) *Mariscus* and *Eriophorum angustifolium*, and, of course, for the rare *E. alpinum*, which grew on the drier or firmer parts of the Moss. Mr. Don remarked that in a few years the plant would disappear, which I understand has accordingly happened."

Mr. John Mackay, Principal Gardener of the Royal Botanic Garden, Edinburgh, having died on the 14th April, 1802, Sir J. E. Smith and Brodie of Brodie strongly recommended Don for the post to Professor Rutherford, the Regius Keeper of the Garden; he was appointed,[1] and removed to Edinburgh, on or about the 12th December 1802,[2] leaving his Forfar garden in

[1] "I have got your correspondent, Don, the Botanic Gardens, at Edinburgh. There he will do well and be of great service to Dr. Rutherford and the public."—*Smith Corresp. Linn. Soc.; Brodie of Brodie to Sir J. E. Smith, 24th October 1802.—I. B. B.*

[2] "It is but 2 week since I come to the Edinburgh Botanic Garden."—*Winch Corresp. Linn. Soc.; George Don to N. J. Winch, 26th December 1802.—I. B. B.*

the care of his father, who was himself a great cultivator of flowers for amusement.[1]

While living in Edinburgh on terms of friendship with Dr. Patrick Neill—whose firm, Neill & Co., were the printers of his "Herbarium Britannicum"—he explored the district round "Scotia's darling seat" with untiring assiduity, discovering many species that were new to the district, including *Vicia lutea*, which he gathered in company with Patrick Neill at North Queensferry in 1804, and *Valeriana pyrenaica* in Colinton Woods. The Pentland Hills were a favourite resort, and there he got *Galium uliginosum* as a new Scottish species; Roslin Glen and North Berwick Law were also made to yield their treasures.[2]

He was elected an Associate of the Linnean Society in 1803 in recognition of his services to Botany, and he was also a Member of the Natural History Society of Edinburgh.

In 1804 he began the publication of a "Herbarium Britannicum," which was dedicated by permission to that well-known patron of science, Sir Joseph Banks, in July of that year,

[1] As Gardener of the Royal Botanic Garden, Don received forty pounds a year as wage. *Pipe Roll.—The declaration of the Account of Dr. Daniel Rutherford, Regius Professor of Botany in the University of Edinburgh, for the monies impressed into his hands for the support of the Botanic Garden at Edinburgh from 5 January 1803 to 5 January 1809.—I. B. B.*

[2] The following extract from a notice of a meeting of Wernerian Nat. Hist. Socy., 13th May, 1809, records Don's botanical activity when resident in Edinburgh:—The Secretary "produced a list of about 100 herbaceous plants and 200 cryptogamia, found in the King's Park, Edinburgh, and not enumerated in Mr. Yalden's catalogue of plants growing there (published in the appendix to Lightfoot's "Flora Scotica"); communicated by Mr. G. Don of Forfar, late Superintendent of the Royal Botanic Garden at Edinburgh."—*Scots Magazine, 1809 (vol. 71), p. 327.*

In the memoirs of the Wernerian Natural History Society, Vol. I., p. 215, is a paper, "A List of the Rarer Plants observed in the Neighbourhood of Edinburgh," by Robert Maughan, Esq., F.L.S. (read 9th December 1809), which says:—

"Since the publication of Lightfoot's 'Flora Scotica,' in 1777, a very considerable addition has been made to the catalogue of indigenous and naturalized plants of Scotland, particularly by the researches of the indefatigable Mr. George Don of Forfar, and of the late Mr. John Mackay of the Botanic Garden at Edinburgh.

"The following list contains an enumeration of such of the rarer species and varieties as have been observed within a day's excursion of the metropolis."—*I. B. B.*

although the preface is dated May 1st, 1804. Four fasciculi each of twenty-five plants, were to be issued yearly, and these were to contain a due proportion of alpine plants. "Since he first began his botanical excursions into the Highlands of Scotland, in the year 1779, he is confident (and he hopes he may mention it without the imputation of vanity) that he has traversed more of the Caledonian alps than any other botanist has ever done. He has repeatedly ranged over the great mountains of Angusshire which surround the great district of Clova, where no one on a similar pursuit has ever preceded him. He has also searched the vast range of mountains which stretch about sixty miles through the district of Knoydart, in Inverness-shire, a region which had never before, nor has since, been examined by a botanical eye. He is the only botanist, too, who has explored the lofty mountains of Cairngorm and the great hills of the neighbourhood." So he wrote in his preface.

Two of these fasciculi appeared in 1804, Nos. III and IV in 1805, Nos. V and VI in 1806, VII and VIII, although dated 1806, did not appear until 1810, as is shown by a letter from Don to Mr. Winch,[1] and No. IX, although also dated 1806, from its including *Astragalus campestris*, gathered in 1812, was probably issued in the latter part of that year or early in 1813.

Don did not long remain at Edinburgh. Dr. Neill writes[2] :— "Mr. Don had not had experience in the cultivation of stove plants, and, it must be confessed, did not shine in that depart-

[1] I am much obliged to you for your kindness in saving specimens for my herbarium as I am now imployed in finishing my 7 and 8 numbers after a stand of nearly 4 years, for if I had not got Subscribers to enable me to have carried it on I could a predicted my Discoverys would a have been very limited in future, but although my subscribers are not numerous yet I flatter myself they are respectable and likely to continue—and on my part shall exert every endeavour to make them interesting—if I remember right I have sent you the new plants which I have given in my 7 and 8 numbers, which are *Campanula persicifolia*, *Sagina maritima*, nova species, *Potentilla opaca* of Linn., *Rottboellia filiformis*. I am to send you a package for Mr. Harriman, which I beg you will take the trouble of forwarding along with yours if you would have the goodness to send the specimens you have collected for me, and I will get some of them to help my 9 and 10 numbers. —*Winch Corresp. Linn. Soc.; George Don to N. J. Winch, 18th Feb. 1810.* —*I. B. B.*

[2] Biographical Notice of the late Mr. George Don of Forfar.

ment. At the same time there can be no doubt that, as a botanist, he greatly excelled the Professor, who was an accomplished chemist, but had little turn for Botany. It thus happened that there soon arose a want of cordiality between the parties; and Mr. Don contemplated a return to his favourite spot of ground at Forfar.[1] During his residence in Edinburgh he attended nearly all the medical classes with the view of ultimately following that profession."[2] I imagine, moreover, the love for a more untrammeled life was a not unimportant factor in the reasons which led to Don's return to Dovehillock.[3] The exact date I do not

[1] Dr. Neill gives another reason in the "Scots Magazine," July 1809, where he deplores the want of financial support given to the garden, and then, speaking of the salary of the Principal Gardener, he refers to Don in these terms:—"The most eminent practical botanist in this country, left his situation in disgust, it is said, on account of the insufficiency of the stipend." This was written within about a couple of years of Don's leaving the garden; the biographical notice quoted in the text appeared about forty-five years after this event. Don himself refers to his post as not being lucrative. (See p. 191 of these "Notes.")—*I. B. B.*

[2] Don became neither a graduate of the University of Edinburgh, nor a licentiate of the Royal College of Physicians nor of the Royal College of Surgeons of Edinburgh, although, according to Dr. Neill, he subsequently practised medicine at Forfar. What classes Don attended can hardly now be ascertained. The matriculation album of the University of Edinburgh does not contain the name George Don in any of the years from 1802 to 1807, but in the Index of Matriculated Students for the year 1804 the name George Don occurs with the word "chem." added, indicating, apparently, that the said George Don attended the class of Dr. Thomas Charles Hope, then Professor of Chemistry. Class-records are not preserved in the University, and the earliest class-record in the possession of Professor Crum Brown, the present holder of the Chair of Chemistry, is that of the year 1806. We have therefore no evidence by which we could identify this George Don with the Forfar botanist.—*I. B. B.*

[3] Mr. Knox, after quoting in his notice of George Don the letter, transcribed on page 82 of this memoir, from Mr. Booth to Sir J. E. Smith, asks:—"To what does Mr. Booth refer when he speaks of Don's incapability of 'sprawling at the footstool of power, and licking the holy dust'? Has it any connection with his short tenure of the office of Superintendent of the Royal Botanic Garden at Edinburgh? Did his political opinions make the place too hot for him? It may be so. There is no direct evidence as to what his politics were, but those of his Forfar associates are known to have been radical enough. Or is it wrong to attribute his resignation to this cause? Was it not rather due to the fact that he was too far away from his beloved Highland hills, and would not be cooped up in Edinburgh?" .

We may, I think, regard Mr. Booth's outburst as the declamation of an

know, but in the Winch Correspondence there is a letter from Don dated from the Royal Botanic Garden, Edinburgh, on December 3, 1805, and another one dated from Forfar on December 6, 1807. The removal took place, therefore, somewhere between these dates,[1] when he devoted himself to the practice of medicine as well as continuing his business as a florist, as is evidenced by a letter he sent to Mr. Booth,[2] brewer, afterwards schoolmaster, of Newburgh—who wrote the article on "Brewing" in the "Penny Cyclopedia" and compiled the "Interest Tables" which are to be found in almost every bank office—in which he says he sends him a powder for scrofula,[3]

intimate friend of the author of "Political Justice," of a man who, as Professor Dowden says, "was in principles a republican." To every impartial reader of what is set forth regarding Don in these pages the reason for Don's resignation will be apparent, and it is that suggested by Mr. Knox and Mr. Druce. By nature and by habit of life Don was not suited to the environment in which he found himself in Edinburgh, and one need suggest neither jealousy on the part of the Professor nor resentment on the part of Don as determining factors in the case.—*I. B. B.*

[1] Probably at the end of 1806 or beginning of 1807. He was at the Botanic Garden in the early part of 1806, when he received a premium from the Highland and Agricultural Society for an essay on Grasses. (See p. 191 of these "Notes.") In the letter of December 6, 1807, he says, "Since my return to Forfar I have made several excursions and found a good many new plants," from which we may infer he had been at Forfar during the plant season of 1807. The Pipe Roll unfortunately does not mention the name of the Gardener in any of the years during which Don was at the Royal Botanic Garden. The wage of the Gardener in each of the years 1803, 1804, 1805, 1806 is passed at forty pounds. In the year 1806 it is stated at fifty pounds, and there is a grant of sixteen guineas to the Gardener "for Extra Expense." Could this have to do with Don's leaving the Garden? In the year 1807 the wage is again forty pounds.—*I. B. B.*

[2] Mr. Booth was a friend of Wm. Godwin. His wife, Isabel Baxter, the daughter of a Dundee manufacturer, was the girlhood friend of Mary Godwin, afterwards wife of the poet Shelley. Mary Godwin was a frequent visitor to the Baxters in Dundee, and Mr. David Booth is well described in Professor Dowden's "Life of Shelley."—*A. P. Stevenson, Dundee.*

[3] Botanic Garden, Forfar, November 19, 1812.

DEAR SIR,—I have procured two volumes of botanical plates with some difficulty. I have given my line to David Mudie, and Mr. Roberts has become bound for me that they shall be returned at the end of two months, and then I shall endeavour to procure the other when you return the two just now sent. I have sent the powder for scrofula with directions.

I will thank you to send the *Jasmine fruticans* and *Serapis latifolia*, and

and it is said that he might have done well at this calling had not his frequent absences from home on his botanical wanderings been inimical to his success.

One may allude to the great tract of country he, at one time or other, explored. Not only Clova was repeatedly worked, but he visited the distant Ben Nevis, where he gathered *Sagina alpina*, and a grass which he thought was Smith's *Poa flexuosa*. Ben Lawers was again and again explored. He gathered *Arenaria sulcata*, and saw the long-legged plover on it in 1793, and in the following year gathered the rare rush *Juncus castaneus*. In 1798 he found *Carex saxatilis*, and in 1804 *Juncus supinus*, and he was the first to report the beautiful *Myosotis alpestris* from that rich hunting ground. On Ben Lomond he discovered *Carex saxatilis*, and saw *Cerastium alpinum*; on Ben Voirlich he gathered the pretty *Saxifraga oppositifolia*; the bold peak of Schehallion yielded *Thalictrum alpinum* and *Carex vesicaria*, and Ben Chonzie, which he spells "Ben-a-conich," gave him a form of *Cerastium alpinum* which he mistook for *C. latifolium*. He also explored the remote and wild recesses of Inverness-shire, finding *Rynchospora alba* plentifully by Loch Nevis, and *Carex filiformis* and a form of *Stellaria graminea*, which Smith thought was a new British species, namely *S. scapigera*, from the neighbourhood of Loch Ericht. The picturesque region of Blair Athol was explored as well as a great part of southern Perth-shire, and his northern expeditions extended to the Isle of Skye, where he gathered *Arabis petræa*, *Brassica campestris*, *Sagina*

seed of *Reseda lutea*, and a plant of the *Scirpus* or Bull Rush that grows by the side of the river at Newburgh [probably *S. Tabernæmontani*], when the frost goes off. With best wishes for the welfare of Mrs. Booth and family.

I remain, dear Sir, Yours truly,

Mr. David Booth. G. DON.

N.B.—I have had a long botanical excursion since I was in Newburgh, and have been successful, having discovered the following new plants to Britain, viz., *Salix lanata* of Linn., and a nondescript species, *Ranunculus nivalis* of Linn. [*R. acris*, var.], *Astragalus campestris* of Linn., *Carex rariflora* of Wahlenberg, and also *Carex salina* of Swortz [*C. vaginata*], and a nondescript species of *Juncus* [*Luzula arcuata*] with many other rare plants, and some new and rare cryptogameous plants.—Yours, as above,

G. D.

P.S.—The parcel is sent agreeable to your directions.

maritima, *Eriocaulon septangulare*, *Schœnus nigricans*, *Scirpus rufus*, *Rynchospora alba*, *Carex pauciflora*, and other plants. Loch-na-gar was repeatedly climbed, and he added a new species to science, namely *Alopecurus alpinus*, from it, with many other rarities. The distant Cairngorm range was visited, and in 1802 he discovered *Carex vaginata* on it, with several rare mosses; Cairntoul was climbed, and he reports the occurrence on it of *Lichen nivalis*; Benn-na-Bourd and Benachie, as well as the huge Ben McDhu were also ascended; on the latter he gathered *Luzula arcuata* in 1812, and on his homeward march found *Hypnum Schreberi* and the lovely *Hypnum Cristacastrense* in fruit, in woods opposite Mar Lodge. The sea shore of the Moray Firth, the woods of Cullen, where he found *Campanula persicifolia* naturalised; the neighbourhood of Gordon Castle, where he saw *Pilularia*; the fir woods of Grantown, where he got *Goodyera repens*; the sea coast of Aberdeenshire, where he found the elegant *Pneumaria maritima*; and the coast of Kincardineshire, were searched, as well as the shores of Loch Leven, Loch Laggan, Loch Katrine, where he noticed the Cranberry, *Oxycoccus quadripetala*, and the Gareloch, were explored. For these long rambles he was especially fitted, being stalwart and blessed with great powers of endurance, often journeying thirty or more miles without breaking fast for a period of twelve hours. He would bring home a heavy burden of plants for his herbarium, or roots to be planted in his garden, or, as was frequently the case, for sale to correspondents scattered over Britain.

Among these correspondents was the Countess of Aylesford, a well-known botanist,[1] who had set herself the task of making water-colour drawings of the British plants. The drawings are now in the possession of a descendant, the Dowager Countess of Dartmouth, and the plants, instead of being thrown away, were kept, and are now in the collection of another descendant of Lady Aylesford's, my friend, Miss C. E. Palmer of Odiham, and amount to no less than 120 species. It was the examination of this collection and the inspection of Don's own herbarium which first convinced me that unmerited injustice had certainly been done to Don by a few botanists.

[1] See Turner & Dillwyn, "The Botanist's Guide through England and Wales." London, 2 vols., 1805.

He sent many specimens to Sir James E. Smith, some of which are figured by Sowerby in the pages of "English Botany," and many of the orginal specimens are preserved in the Smithian Herbarium of the Linnean Society, or in the Natural History Museum at Cromwell Road.

Don's specimens are often accompanied with excellent critical observations which show his botanical knowledge and acumen. Eight letters to N. Winch,[1] that excellent north-country botanist, are also preserved in the Linnean Society's Library, and a small number of critical grasses still await naming in the general collection at Burlington House.

Dr. Goodenough, Bishop of Carlisle, was another correspondent. It is said that the Bishop once being at Forfar, and inquiring for Mr. Don, was at first directed to Colonel, afterwards General Sir George Don, who chanced to be passing up the street; the Bishop, noting the military bearing of the Colonel, said "No, that cannot be the man I want," upon which the native said, "You'll want Doo Hillock," and at once conducted him to the nursery, where he found the botanist hard at work at his plants, and with whom he was soon in cordial conversation, to the wonder of his guide.

Among the common people Don was, of course, either little understood or perhaps misunderstood, such pursuits as his would be looked upon as scarcely canny, but Mr. Knox relates he once extorted their admiration from having been asked by a number of weavers the name of a small seedling at the side of a wall; he, having examined it by means of a lens, told them it was a gooseberry bush. They were sceptical, but the plant was removed by one of them to a garden, and eventually proved that Don's naming was correct. But the more educated people in Forfar recognised Don's merit, and he had the friendship of Mr. Dempster of Dunichen, and Dr. John Jamieson,[2] author of the "Dictionary of the Scottish Language."

George Don's principal contribution to botanical literature is "An Account of the Native Plants in the County of Forfar and

[1] These by the favour of the President and Council of the Linnean Society are published as an Appendix to this memoir.—*I. B. B.*

[2] Dr. Jamieson was in Forfar from 1780–1797.—*Alex. P. Stevenson, Dundee.*

the Animals to be found there," which forms Appendix B to "General View of the Agriculture of the County of Angus or Forfarshire," compiled by the Rev. James Headrick, minister of Dunichen, and published in 1813.[1] In it he mentions ninety species of flowering-plants, a hundred mosses, and a hundred and twenty lichens from Clova. The sub-alpine plants lying between the alpine district and the lowest part of the valley of Strathmore are noticed; there he discovered *Caltha radicans* and *Crepis pulchra*, the latter a casual plant, since extinct (Smith, Eng. Bot. t. 2325, and Syme, Eng. Bot. v. p. 217). Then he discusses the flora of the lochs and marshes in the neighbourhood of Forfar, where he planted *Stratiotes*, and he noted nine species of pond-weeds from Rescobie Loch. He next describes the plants growing between the valley of Strathmore and the sea. Lastly, the sea-coast, from North Water Bridge, Montrose, Arbroath, Sands of Barrie, Dundee, and the banks of the Tay to the western boundary of the county, are pleasantly described. Altogether about three hundred "larger and rarer plants" are enumerated, and he says that most of these could be seen growing in his garden at Forfar. Don makes a rather scathing criticism upon the views of a Dr. Richardson of Ireland, on the qualities of the fiorin or bent-grass as a food for cattle, for, as the book was specially written in the interest of agriculture, special attention was given to the nutritive qualities of the native grasses. Don also gives lists of fuci, confervæ, zoophyta, infusoria, mammalia, birds, fishes, insects, worms, molluscs, and testacea; for he had a very considerable knowledge of zoology as well as botany, being a naturalist in the true sense of the word.

That Don succeeded for a time with his garden is evidenced by the following "Account of Forfar Garden," from the pen of Dr. Neill, which appeared in "The Scots Magazine" for June, 1809:—

"The existence of a flower garden and flower nurseries at Forfar, which for number, diversity, and rarity of the hardy plants cultivated in it are perhaps scarcely to be surpassed in Britain, is a fact not generally known. We think it right to give it what publicity is in our power, both as a piece of interesting information to botanical amateurs, and of justice to the indefatigable exertions of Mr. George

[1] A reprint of this is given as Appendix F to this Memoir.—*I. B. B.*

Don, who, we understand, has surmounted many difficulties in following out his favourite pursuit, and in forming so extensive and curious a collection of living plants. The whole of the plants are of a hardy sort, Mr. Don not possessing either green-house or stove for the protection of such as are tender. It is in *alpine plants* and in *hardy perennials*, and *annuals*, that the Forfar garden excels. The garden is situated on a bank which slopes down to the lake of Forfar, not far from the town; and it fortunately includes a great variety of soils, from dry to peat bog. No place could be found more favourable for alpines and aquatics, which are in general found to be of rather difficult cultivation, but which flourish here as in their native habitats. . . . To give some idea of the extent of the collection, I shall mention the number of species of several genera which are at present growing in the garden. Of the genus *Veronica*, there are 55 species, of *Salvia* 50 species, *Campanula* 44, *Allium* 40, *Saxifraga* 46—some of the rarest ones, as *S. cæsia*, *S. petræa*, *S. rivularis*, etc.; *Dianthus* about 20 species, *Cucubalus* 13—being the whole ever cultivated in Britain; *Silene* nearly 50, *Fumaria* 14, the genera *Ononis*, *Lathyrus*, *Vicia* almost complete, *Astragalus* 40 species, *Trifolium*, no fewer than 69, *Hieracium* 44. It were needless to enumerate more. The botanist will form a due estimate of this collection on being told that he may see here upwards of 60 species of *Carex*, flourishing in great perfection. The agriculturist may here find the whole of the hardy Gramina, carefully distinguished and arranged, amounting to over 100 kinds. This season Mr. Don has introduced several hundred species of hardy plants, most of which we are told have never before been cultivated in Scotland. Among the rare British plants at present in flower in this garden may be mentioned the elegant little grass called *Knappia agrostidea* (*Agrostis minima* of Smith)and the *Holosteum umbellatum*. Among the hardy exotics now in flower, the *Panax quinquefolia* (the root of which constitutes the famous panacea of China called ginseng) is most remarkable. There are certainly very few living specimens of the plant in Scotland; and we have not before heard of its flowering in this country. The *Dalebarda fragarioides*, brought from North America to France by Michaux and only lately imported into Britain, has already found its way into Mr. Don's collection. It is entirely a new plant, belonging to the Icosandria Polygynia, and naturally allied to the Geums.

"The Forfar garden, it must, however, in conclusion, be confessed, makes very little external show, being in a great measure destitute of the ornament which arises from neat alleys with hedges or

edgings, or well laid-out or well-kept gravel walks. It is, in fact, merely an uncommonly excellent collection of hardy plants; and while it would doubtless fail to please the lover of tasteful gardening, it would as certainly prove highly interesting to the botanist and to the curious cultivator. Mr. Don, we have been told, has an ample nursery of rare hardy plants, for which he receives orders from the curious in different parts of Britain; and, when the proceeds of these shall enable him, we understand it to be his intention to improve the exterior appearance of his garden." [1]

Again, in the "Scots Magazine" for June, 1810, Dr. Neill, under the heading of *Scottish Alpine Plants*, thus refers to Don's work and garden:—

"That indefatigable and acute botanist, Mr. George Don, of Forfar, has lately explored Ben Lawers, and some of the neighbouring mountains in Breadalbane, for the fourth or fifth time. His success has been greater than on any former occasion. He found the *Carex ustulata* or Angebrannte Segge of Willdenow, figured by Schkuhrius, in his monograph on this difficult genus, under the title of *C. atro-fusca*. It has hitherto been considered as a native only of the mountains of Lapland and of Iceland. It was growing at no great elevation, but sparingly. He found likewise two rare species of *Eriophorum*, now for the first time ascertained to be natives of Great Britain—viz., *E. gracile* of 'Annals of Botany,' and *E. Scheuchzeri*, neither of them described in Willdenow's new edition of the 'Species Plantarum'; the last-mentioned curious and interesting species seemed to have been washed down from some inaccessible cliffs and crevices of the mountain, the plants being apparently newly rooted in the alluvion from the summit. Mr. Don having previously observed *E. alpinum* in the Moss of Restennet, near Forfar, has thus had the merit of adding three species of one genus to the British Flora. Some non-descripts are likewise among his recent discoveries, particularly a Cerastium and an Arenaria; and he brought with him several little known species of grasses belonging to the genera Poa, Triticum, and Festuca, some of which indeed may also prove non-descript. All of these novelties Mr. Don is to endeavour to cultivate in his garden at Dove Hillock, close by Forfar, a spot where a greater variety of curious hardy and alpine plants is collected than is perhaps to be met with in the finest gardens in Great Britain."

[1] Here we have a picture of the conditions which led to the confounding of plants referred to on page 142.—*I. B. B.*

Don had a practical knowledge of forestry and agriculture and was frequently consulted by landowners as to the planting of their estates.[1] In illustration of this may be quoted the following communication[2] which appears in the "Memoirs of the Caledonian Horticultural Society," Vol. i., 1814:—

"ON THE VARIETIES OF THE PINUS SILVESTRIS, OR SCOTS FIR.

"BY MR. GEORGE DON, FORFAR.

"Communicated in a Letter to Mr. P. Neill.

"(Read 5th March, 1811.)

"I am not acquainted with the latitude of subjects your Horticultural Society means to embrace; but I trust the following observations on the Pinus silvestris of Linnæus, the well-known Scots Fir, may not be unworthy of its notice.

"One would be apt to think that little new were to be expected concerning the history or qualities of a tree that is not only indigenous to our country, but has been cultivated among us from time immemorial; especially after an excellent monograph on the genus Pinus, by a first-rate botanist and observer, Aylmer Brook Lambert, Esq.; F.R.S. and a Vice-President of the Linnean Society, published not longer ago than the year 1803.

"During the winter of 1810, when walking in some woods in the neighbourhood of Forfar, composed of Scotch Fir, for the purpose of collecting mosses and lichens, my attention was withdrawn from these humble tribes, by observing the very dissimilar appearances of different trees, of what botanists consider as one species of Pinus, the Pinus silvestris.

"After examining a great number of trees, I became satisfied that it is possible to distinguish in our plantations, at least *four*

[1] Mr. Don of Forfar, to whom this work is under such high obligations, has been employed by several gentlemen, not only of this but of neighbouring counties, in stocking parks which are intended for permanent pasture with the most valuable of those grasses which are natives of the county; and also in extirpating such plants as are hurtful to cattle.—*Headrick, General View of the Agriculture of the County of Angus or Forfarshire, Edinburgh, 1813, p. 349.*

[2] See also his essay on "Indigenous Grasses," reprinted as Appendix E to this Memoir, for which he was awarded in 1806 a premium by the Highland Society of Scotland.—*I. B. B.*

varieties; and one of these indeed is of so fixed and marked a character, that it may probably be entitled to rank as a species.

"It seems somewhat curious, that in Dr. Smith's Flora Britannica, in Hull's British Flora, and in Withering's Arrangement,—while perhaps not fewer than six or seven varieties of some species of plants, not of the least known economical use or importance, are enumerated,—not one variety of the Pinus silvestris should be noticed.

"It may here be proper to state, that lately, while observing the cutting down of a fir plantation, near Forfar, I was not a little surprised at the great difference in the size, and consequently the value, of some of the trees in comparison with others of the same species, the difference in value being not less than four times that of others, and in some individual trees exceeding six times. I was at a loss to account for this fact, as the trees were growing promiscuously in the same soil and situation, and had been equally thinned. On more minutely examining those trees that far exceeded the others in size, I perceived that they were all of that variety which I have suggested as probably entitled to rank as a species.

"About a month ago, I re-examined the varieties of the Pinus silvestris, in order to collect some cones of each variety for seed; and I was then led to examine them with considerable care.

"I think the following remarks may tend to distinguish and characterize the different varieties.

Var. 1.

"The Common Variety, which I shall rank as the first, is well known by its branches forming a pyramidal head; the leaves being marginated, of a dark or full green colour, and but little glaucous underneath; the cones being considerably elongated, and tapering to the point; and the bark of the trunk being very rugged. This variety seems to be but short-lived, becoming soon stunted in its appearance, and it is altogether a very inferior tree to either var. 2 or 3.

Var. 2.

"This strongly marked and permanent variety, is distinguished from the former, by the disposition of its branches, which are remarkable for their horizontal direction, and for a tendency to bend downward close by the trunk. The leaves are broader than in var. 1., and serrulated, not marginated as in var. 1. From that circumstance alone, I should at once pronounce them distinct. The

leaves are distinguishable at a distance by their much lighter and beautiful glaucous colour. The bark of the trunk is not so rugged as in var. 1. Its cones are generally thicker, not so much pointed, and they are smoother than those of var. 1. The tree seems to be a more hardy plant, being easily reconciled to very various soils and situations. It grows very freely, and quickly arrives at a considerable size.

"This is the sort which I conceive might constitute a distinct species; and from the disposition of its branches, I would be inclined to call it Pinus *horizontalis*.

"May I here be allowed to conjecture, that the fir woods which formerly abounded in every part of Scotland, and the trees of which arrived at a large size, had been of this variety or species? I have certainly observed, that the greater part of the fir woods of the present day, and which are so much complained of, are of the common variety, or var. 1.; at least not more than one tree out of ten or twelve, is of var. 2., or the more desirable kind. I think this the most natural way of accounting for the supposed decline of the Scots Fir in this country; for two reasons; 1. Because var. 2. still retains all the good qualities ever ascribed to the Scots Fir; and 2., Because, as var. 1. produces its cones much more freely than the other, the seed-gatherers, who were only to be paid by the quantity and not by the quality, would seize upon the former, and neglect the latter.

"The evident remedy for this defect in our plantations of Scots Fir, is therefore the cultivating exclusively this second and well marked variety.

"Even granting it to be only a *variety*, it seems indisputable, that any fixed variety in a timber tree, rendering it more valuable, is as well worthy of being attended to, as are fixed varieties in cultivated grains, or culinary vegetables; and the great improvements that have resulted to agriculture and horticulture from attending to such varieties, are too well known to need to be insisted on.

Var. 3.

"This is likewise a remarkable variety, and seems quite distinct both from var. 1. and 2. Its leaves are of a still lighter colour than those of the last; insomuch, that they appear of a truly light glaucous hue, approaching to a silvery tint. Its branches form, like var. 1., a pyramidal head; but it differs remarkably in its cones, from both the former varieties; the cones in this variety having the

appearance of being beset with blunt prickles, bent backward. The leaves are serrulated,—a character which at once distinguishes it from var. 1., with which the tree agrees in having a pyramidal head. This variety is more common than var. 2., and it is also a good tree.

Var. 4.

"I have observed a fourth variety, the leaves of which are somewhat curled or rather twisted, and much shorter. This seems to be a scarce variety, as I have not hitherto seen more than three or four trees of it. It very nearly approaches Pinus Banksiana of Mr. Lambert's Monograph.

"Before concluding, I may remark, that Mr. Lambert, in his Monograph, mentions a variety found by Thunberg in Japan, having the branches horizontal. Can this be my var. 2.? Mr. Lambert thinks it may be a distinct species.—And I beg leave to add, that as I have collected seeds of all the above varieties, and have sown them in my grounds at Forfar, I hope to be able, in the course of the autumn, to show the young plants to any gentleman desirous of distinguishing the varieties in the seedling state. I have collected all the cones I could possibly find of vars. 2. and 3., being the most valuable, and mean to raise them extensively, as the most effectual means of promoting a reform in this department of the nursery business.

"Forfar Garden,
10*th February*, 1811."

Despite all his exertions Don's pecuniary affairs did not prosper.[1] His long absences on botanical expeditions in later years interfered with his business. On some of these he took with him one of his apprentices or workmen, who had little

[1] Mr. Knox has in his possession a "Day Book" of Don's business covering the period from 1811 to 1815—that in which took place the crash in Don's affairs, his death, and the attempt by his sons George and David to carry on the nursery. He has kindly granted me the privilege of perusing it. The transactions are few and the sum obtained by them but a pittance. The plants recorded as sold form a noteworthy list, and Don's nursery must have contained a stock of plants remarkable both in quantity and in botanical quality. Two accounts in the book are of special interest:—Messrs. Dickson & Sons, nurserymen, Edinburgh, buy over 500 species of herbaceous plants, and from them the Edinburgh Botanic Garden obtained many of its plants; Mr. Hopkirk of Dalbeath is also a purchaser of out-of-the-way herbaceous plants, and his collection was the foundation in 1819 of the Botanic Garden of Glasgow.—*I. B. B.*

relish for the hardships such expeditions involved, the camping-out at night being especially distasteful, so that some left his employ. Again the sale of the specimens gathered, the occasional preparation of a hortus siccus to order, gave no adequate remuneration, so that his affairs became more and more embarrassed, until in 1812 some sort of arrangement had to be made with his creditors. From this blow the independent and rather choleric temperament of Don never recovered. And I rather fancy that the publication of the ninth volume of the Herbarium Britannicum, in which he used the printed title page of the preceding issue, was made in order to add a little to his store. It was probably his last publication, for we find that he came home from one of his expeditions in the autumn of 1813 labouring under a severe cold, and this neglected grew gradually worse. A suppurating sore throat ensued, and under conditions of poverty so extreme that he and his family had to depend for their daily bread upon the charity of neighbours, he lingered in excruciating agony for six weeks. He died on the 15th of January, 1814.[1] His funeral, Mr. Knox writes, according to the testimony

[1] By the courtesy of the Keeper of the Botanical Department, British Museum, Cromwell Road, the following letter is published in which Dr. Neill announces the event to Dr. Robert Brown :—

Canonmills, 28th Jan., 1814.

MY DEAR SIR,—I regret to say that our extraordinary botanical friend, G. Don, is no more. He died at Forfar on the 15th in consequence of an inflammatory sore throat to which he paid no regard till it was too late.

You knew the man, and will not be surprised when I tell you that his family is left in the most deplorable state of misery and want. Botanists must contrive something for their benefit. I shall let you know what is projected here, and doubt not that your influence with members of the Linnean Society will not be wanting.

We have subscribed a few guineas here, and sent to the Rev. Mr. Adie, Forfar, and to Mr. Thompson, nurseryman there, to be disbursed for their behoof to relieve the pressing wants. I believe there are four boys and a girl. The latter is an object, incapable of doing anything for herself. . . —Dear Sir, yours truly, P. NEILL.—*Brown Corresp. Brit. Mus., Cromwell Road.*

The following are contemporary notices of the event :—

"Died, at his house, Botanic Garden, Forfar, on the 15th ultimo, Mr. George Don, F.L.S. and honorary member of the Dundee Rational Institution, in the prime of life and vigour of his pursuit of his profession. As a botanist, he undoubtedly stood high among his countrymen, and was no

of some still living that were present, was one of the largest which, up to that time, had been seen in Forfar. The whole town turned out to witness it, and followed the coffin to the grave in the churchyard.

This is the more extraordinary as during his lifetime he was as one apart from the crowd, one whose pursuits the crowd had no sympathy for, and he would have been described by many as the Kirkcaldy man described Adam Smith—"A puir cratur, gangs stotting about on the sands there for hours, and naebody kens what's in his head." He never mixed much with them or with burgh politics, not because he had no strong political beliefs, but rather because his means did not allow himself to touch municipal matters, soiled as they were so often in these times with petty meannesses or definite jobbery. We learn, however, that he joined a section of Forfarians, the followers of William Godwin, the founder of philosophic radicalism, and who adopted as their creed the principles—so far as they were practicable—laid down in his "Inquiry concerning Political Justice." This section of thinkers were mainly instrumental in forming the Forfar Library, which in addition to books also contained a microscope, telescope, and other philosophical instruments. Don became a member of the library in 1799 in consideration of his having presented three volumes of botanical drawings, being admitted without payment of dues. Don's poverty may be assumed from this, as being too poor to pay the usual subscription he is admitted on his gift of these volumes, one of which, containing figures of Fungi by Sowerby, is still in existence in the library.

mean disciple in the Linnæan school. In his premature death the science of botany (especially the cryptogamia department) has lost a most successful student, as in this branch of the science his researches were likely to be highly advantageous. He has left a family to lament the loss of an affectionate husband and tender parent; and in the circle of his acquaintance he was a social and communicative companion."—Dundee, Perth, and Cupar Advertiser, February 4th, 1814.—*Alex. P. Stevenson, Dundee.*

"Obituary, January 15th.—At Forfar, after a short illness, Mr. George Don, formerly Superintendent of the Royal Botanic Garden at Edinburgh. The extraordinary merits of Mr. Don as a practical botanist are very generally known, from the frequent and well deserved eulogies bestowed on him in Dr. Smith's "Flora Britannica" and Sowerby's "English Botany."—*Scots Magazine, 1814.—I. B. B.*

His companions were readers, and met regularly to discuss books, politics, and general news in "Nanny Dagetty's," a small public-house in the East High Street, and there he sometimes surprised his comrades by coming in from some long expedition hungry and tired, and speedily clearing the table of all provisions. His comrades, drawn together by a similarity of opinions, were sympathisers with the French Revolution and were losing heart at the form of religion as then taught in many Scottish pulpits. They were clear-headed and intelligent, and their testimony to Don's qualities is complete and emphatic. Two letters from his friends which Mr. Knox has published bear this out, and the testimony is the more to be valued owing to the suggestions of moral turpitude by inaccurately recording plants which one or two botanists in later years have made against him, but which I trust the evidence produced in this article may do much to qualify. The first letter is from his friend William Roberts of Forfar to David Booth of Newburgh, and is dated Forfar, January 18, 1814.

DEAR SIR,—Mr. Rodger [a well-known Forfar lawyer] says he wrote you yesterday communicating the unpleasant news of the death of our friend George Don, but had omitted to request you to write a short sketch of this singular and celebrated botanical genius, and to cause a sketch to be published in one of the English diurnal newspapers. To stimulate you to this is my chief object in writing at present. A man of eminence in an art or science is entitled to notice, and when he leaves the world it argues a degree of inexcusable insensibility to devote no attention whatever to his memory. George was not only a self-taught man of science, but he was our particular friend. I therefore expect that you who knew every trait of his character will not delay a moment in taking up your able pen to celebrate his memory. Your description will aid a benevolent plan which a number of your acquaintances here have formed in behalf of the unhappy orphans left by our friend. Judge, then, how anxiously we will look for the effusion of your pen to departed genius and modest worth.

George's family consists of five sons and one daughter. The two elder sons, George and David, have studied botany under their father, and have made considerable proficiency. They know the greater part of the immense variety of plants in the botanical garden. The second son, David, is a fine boy of about sixteen years of age,

modest, communicative, and sensible, and the knowledge he has already acquired of plants would astonish you. Were his genius to be properly cultivated, I have not a doubt that he would soon be little inferior to what his father was in the science of botany. A number of individuals here have it in contemplation to support these two young men, to enable them to reside with, and provide for, the three infant sons. With a view to this benevolent plan, letters are to be sent to those gentlemen who corresponded with George on the subject of botany, soliciting their aid. Perhaps a small sum may be raised in this way to preserve the family from starving, and to enable the two elder sons to follow their pursuit in the knowledge of botany; and if they meet with any encouragement, they may possibly become an acquisition to the world. They are young and vigorous, and able to traverse alpine regions in the pursuit of rare plants. The eminent Dr. (Sir James E.) Smith patronised and justly appreciated the talents of the father. Perhaps you could apply to him for some aid to this friendless family. When Don died he was completely in want, and I believe your good friend Mr. James Webster was the first to throw in a temporary supply.

Ever your sincere friend, WILL. ROBERTS.

Mr. Booth carried out the proposal suggested, and applied to Sir James E. Smith, as will be seen from the following letter written by Mr. Booth from London, January 24th, 1814:—

SIR,—Mr. George Don, of the Botanic Garden, Forfar, was for many years my intimate Friend. I also understand that he was your constant correspondent. He is now no more. He died on the 14th inst., of a putrid sore throat, after six weeks excruciating pain. My residence is at Newburgh, Fife. I have been in London these two weeks past, and the above intelligence was communicated to me in a letter from Forfar. My correspondent states further that Mr. Don died in extreme poverty, having been obliged during his illness to accept of the private donations of Friendship, which must have ill accorded with his independence of mind. He has left a Widow and six Children, four of whom are incapable of labour. Two Sons (who, I suppose, are from fifteen to sixteen years of age) have been accustomed to work in the Garden, but they are quite unfit either to continue or to sell off the valuable collection of Plants which it contains. Indeed, there is no one in that quarter that can appreciate their value; and what has been

collected by the labour of years, will most probably be thrown out as useless cumberers of the ground.

I address you, without ceremony, as the Guardian of British Botany, to the advancement of which Mr. Don dedicated his life. In that department *you* knew his value; *I* knew him not only as a Botanist but as a Man, and I knew that, had he been capable of sprawling at the footstool of Power and licking the holy dust, it would not now have fallen to my lot to call upon his Friends to save his Family from Ruin.

I leave London in a few days; but should you be able to suggest any means to assist this unfortunate Family, and should you require any further information on the subject, you will oblige me by writing and poste to Newburgh if you have no Correspondent nearer Forfar. I am with much respect, sir, your obedient servant, DAVID BOOTH.

To the letter Sir James E. Smith sent the following reply:—

Norwich, February 4, 1814.

DEAR SIR,—The intelligence of your obliging letter of January 24 is truly grievous. Your name has been mentioned to me in the most respectful manner, and therefore I rely on your goodness to perform what I wish for the benefit of our lamented friend's family. I wrote immediately to Mr. Dawson Turner, Mr. Lambert, Sir J. Banks, and the Bishop of Carlisle. I have as yet an answer from Mr. Turner only, who, being in debt to Mr. Don 4 guineas, has generously sent me £20 to pay it. To this I am happy to add £5, which is all that my circumstances justify, as I have, like our friend, sacrificed all to science, except what I derive from a slender patrimony.

I hope something will come from the above sources, and many others to which I shall apply, but meanwhile £25 may be important to the widow.

I have also consulted some friends about the plants, but to no purpose. I have begged Mr. Sowerby to consult some common friends in London.

Mr. P. Neill of Edinburgh has written to me on the same subject as yourself. If you have any communication with him, as I presume, please to inform him that I am giving attention to the subject—but, above all things, I am unable to write many letters. When I go to London in April I do not doubt picking up many a pound for the good cause. Only, please appoint a place for it to

be paid into in London as it comes. I must mention that, as President of the Linnean Society, I have never allowed any subscription whatever to come before the Society as a *body*, for many reasons, but I will do all I can with individuals. Is not Mr. Brodie of Brodie likely to assist? I remain, Sir, your obliged and obedient servant, J. E. SMITH.

The subscription list thus commenced was kept up till the following August, under the treasurership of Dr. Neill, and a sum of about £80 was obtained. Mrs. Don removed to Newburgh, and to Mr. Booth, her husband's friend, was remitted from time to time, as required, the sum mentioned above. And it must have been well spent. Of the six children of her large family of fifteen who survived their father and reached adult age, all were brought up respectably, and the five sons followed their father's calling as gardeners.

The eldest son surviving to manhood, George, who died unmarried, eventually became a botanist of no mean repute, being a Fellow of the Linnean Society and the author of "A General History of the Dichlamydeous Plants," founded upon "Miller's Gardener's Dictionary," and commonly known as "Don's Gardener's Dictionary." The following is the obituary notice of him from the Proceedings of the Linnean Society for May 24th, 1856, p. xxxix :—

GEORGE DON, Esq., was born at Forfar on the 17th of May, 1798. He was the eldest son of the zealous British botanist of the same name, well known as the discoverer of many of the most interesting plants of the Scottish Highlands, and a constant correspondent of the late Sir James Edward Smith, who in his "English Flora" (under "Rosa Doniana") speaks of him as "one of the most indefatigable as well as accurate of botanists; who loved the science for its own sake, and braved every difficulty in its service." On the death of his father, in 1814, Mr. Don, in conjunction with his younger brother, David, made an attempt to carry on the nursery which their father had established at Forfar; but the business was shortly after given up, the elder brother removing in 1815 to Edinburgh, where he was for a time employed in the establishment of Messrs. Dickson and Co. In the following year he came to London, and after a short engagement at the Portman Nursery succeeded in obtaining employment at the Chelsea Botanic Garden, then under the charge of Mr. Anderson, with whom he remained as foreman till

1821, when he entered the service of the Horticultural Society, and was shortly after despatched as their collector to tropical Africa, South America, &c. During this voyage, which occupied something more than a year (from December, 1821, till February, 1823), he visited Madeira, Sierra Leone, St. Thomas's, Bahia, St. Salvador, Maranham, Trinidad, Jamaica, Havana, &c., and his activity in collecting and sending home living plants, seeds, and dried specimens obtained for him the highest encomiums of the then Secretary of the Horticultural Society, Mr. Sabine. Many of these plants afterwards flowered at Chiswick, and were described by Professor Lindley in the "Horticultural Transactions," &c. Mr. Don's attention having been particularly directed to the introduction of tropical fruits and the procuring of accurate information respecting them, and his visit to Sierra Leone occurring at a time when many of its fruits (then chiefly known from Dr. Afzelius's Report to the African Society) were in perfection, he was enabled to collect materials for a very interesting account of them, which appeared in the 5th volume of the Horticultural Society's "Transactions," under the title "Some Accounts of the Edible Fruits of Sierra Leone, drawn up by Joseph Sabine, Esq., Secretary, from the Journal and personal communication of Mr. George Don, A.L.S." At the recent sale of the Herbarium of the Horticultural Society, specimens of the plants obtained by Mr. Don during this expedition, and which are valuable not merely in connection with his own botanical labours, but likewise as being, in part, typical of the species described by Messrs. Bentham, Hooker, &c., in the "Flora Nigritiana," were purchased for the Herbarium of the British Museum. His brother David having succeeded Mr. Brown on his resignation in 1822, as Librarian to the Linnean Society, George was for some years domiciled with him. During the earlier part of that period he appears to have been occupied upon a revision of the genus Combretum, which was read before the Linnean Society in March, 1826, and published in the 15th volume of its "Transactions." About the same time Mr. Don also communicated to the Wernerian Society a Monograph of the genus Allium, which is published in the sixth volume of the Memoirs of that Society. From 1828 to 1837 his time was principally occupied upon the "General System of Gardening and Botany," or, as it was afterwards called, the "History of Dichlamydeous Plants," consisting of four quarto volumes, averaging about 880 pages each. The original intention was that the work should include all the known species of plants, and that the whole should be comprised in four volumes; but this

being found impracticable, and the publishers receiving little encouragement to proceed, it was abruptly closed at the fourth volume without its having extended beyond the Dichlamydeae. He shortly afterwards entered into an engagement to supply the botanical articles of the "Encyclopædia Metropolitana," which he continued to do till the close of the work, a great part of the introductory treatise having been furnished by him, as well as the articles in the alphabetical series, from the middle of the eleventh volume to the end of the twelfth. In 1842-3 he was employed by the Board of Woods and Forests in naming the trees and shrubs in Kensington Gardens and the Parks, by means of which the names of a very considerable number of species and varieties of woody plants have become familiar to the visitors. He likewise rendered much assistance to the late Mr. Loudon in the preparation of the various botanical works in which that gentleman was engaged during the last ten or twelve years of his life; and the last of his botanical labours was the preparation of a supplement to Loudon's "Encyclopædia of Plants," which made its appearance only a few months before his death. He had been suffering at intervals during the last two years from disease of the heart, which had latterly prevented him from being present at any of our meetings, at which he had for many years previously been a constant attendant, having been elected an Associate in 1822, and a Fellow in 1831. He died at Campden Hill, Kensington, on the 25th of February last [1856], in the 58th year of his age.

The second son surviving to manhood, David, whose acuteness was alluded to by Mr. Booth, having been employed at the establishment of Messrs. Dickson in Edinburgh, also drifted from horticulture, and going to London became an assistant to Mr. Lambert, the well-known monographer of the genus *Pinus*. He afterwards became Librarian to the Linnean Society, and wrote many papers which appeared in the publications of that Society and elsewhere. At the time of his death in 1841 he was Professor of Botany at King's College, London. The following is the obituary notice of him from the Proceedings of the Linnean Society for May 24th, 1842:—

DAVID DON, Esq., Professor of Botany in King's College, London, and Librarian of this Society, was born in the year 1800, at Forfar, where his father, an acute practical botanist, had established a nursery and botanic garden. On his father's being afterwards

appointed to the charge of the Botanic Garden at Edinburgh, he attracted the notice of Mr. Patrick Neill, and was enabled to attend some of the classes in that city. His father, however, after a while quitting Edinburgh, he returned with him to Forfar, and received his early training in the garden there. Subsequently he again visited Edinburgh, and had charge of the stoves and greenhouses in the establishment of the Messrs. Dickson, of Broughton, near that city, then among the finest in Scotland. Late in 1819 he removed to London, and soon after became librarian to Mr. Lambert, in whose house he was domiciled, and of whose extensive herbarium he had charge. About this period he published "Descriptions of several new or rare Native Plants, found in Scotland, chiefly by the late Mr. George Don, of Forfar," and wrote "A Monograph of the Genus Saxifraga," which appeared in the thirteenth volume of our "Transactions." These publications brought him into favourable notice, and in the year 1822 he became Librarian of the Linnean Society, an office which he continued to hold till his death, and in which he acquired the universal respect and esteem of the members by the wide extent of his information and the liberality with which he was at all times ready to impart it.

On the death of Professor Burnet in 1836 he succeeded to the Botanical Chair at King's College, which he also retained till his decease. His constitution was apparently robust, but towards the end of 1840 a tumour appeared in his lower lip, which it was found necessary to remove. The disease, however, after a short respite, reappeared in the neck, and assuming by degrees a decidedly malignant character, left no hope of his long surviving. He died on the 8th of December last [1841], worn out by severe suffering, which he bore with the most exemplary fortitude, and was buried on the 15th of the same month in the cemetery at Kensal Green. He was married, but left no children.

As a systematic botanist his character stands deservedly high. His knowledge of plants was most extensive, and his appreciation of species ready and exact. The most important of his publications are his "Prodromus Floræ Nepalensis," his monographs of Saxifraga and other genera, and of the family of Melastomaceæ; his memoirs on Compositæ, in our "Transactions"; and his papers, especially those on the plants of Peru and Chile, in the "Edinburgh Philosophical Journal."

The third son, Patrick Neill Don, died in Kent, having been gardener to the Right Hon. A. Beresford Hope at Bedgebury

Park. Another son, James Edward Smith Don, also went to England, being gardener to Earl Amherst, and Charles Lyell Linnæus Don was also gardener at Bedgebury Park, where he was killed in trying to stop a runaway horse.

Don's grandson, the son of Patrick Neill Don, writing from Bedgebury, Kent, in a letter quoted by Mr. Knox, says—"After George Don's death in 1814, my grandmother sold all the nursery stock and went to live at Newburgh, Fife. As my grandfather left no provision for his wife and family, she had a hard struggle to bring up and educate the children decently. Out of the large family of fifteen she bore to my grandfather, only six reached adult age, and one of them, the eldest, and the only girl, I think, died soon after their father, and before they left Forfar. All the five sons were bred to gardening, and they all came to England and settled in different parts of the country. The two eldest sons, George and David, did not long follow gardening, but having ability, and a great love for botanical science, struck out a higher and more congenial path for themselves. The others were not so fortunate, although they all held good appointments in their calling."

The Forfar garden[1] was let to Thomas Drummond, who afterwards became a botanical explorer, especially in Texas and the Rocky Mountains, and he was a tenant for ten or twelve years. On his leaving, the ground was divided. A part was given as a garden to the occupant of the house. The rest was parcelled out in gardens. Soon after this the house became a public-house, and the last traces of Don's garden ceased to exist. The hillock, and all to the west of it, Mr. Knox says is now enclosed

[1] The following is a contemporary record in the "Dundee, Perth, and Cupar Advertiser," April 28th, 1815, of the fate of George Don's collection of plants :—

ADVERTISEMENT.

TO BOTANISTS, &c.

To be disposed of forthwith.

The whole of the PLANTS in the late Mr. George Don's Botanic Garden at Forfar.

Orders addressed to Mr. Don's sons, George and David, will be executed with the utmost care, and on the most moderate terms.—*A. P. Stevenson, Dundee.*

within the grounds belonging to the Canmore Linen Works—the manager of which resides in the house, altered and enlarged, which Don built and lived in.[1] The lake in which he grew his aquatics is filled up and levelled, and covered with grass.[2]

He lies in Forfar Churchyard in a nameless grave,[3] but a street in Forfar bears the name of Don.

The genus *Donia* was dedicated by George and David Don "to the memory of the late Mr. George Don of Forfar, whose numerous discoveries have so eminently enriched the flora of his native land." It is one of the *Leguminosæ* now sunk in *Clianthus*.

Mr. Knox says—"During his short life he did more than any other individual has ever done in stimulating the study of the botany of his native country, especially of the Highlands. His first excursion into the Highlands was made when he was fifteen years of age, and from that time on, during the remaining thirty-four years of his life, his enthusiasm never flagged. He has been the pioneer of all who have since studied the botany of our Scottish Highlands. If the incidents of his life could have been collected when full of life and colour, they would have formed a biography as interesting as that of Dick or Edwards. But at that time literature busied herself but little with such men as George Don. The broadening, humanising influence of Burns had not yet broken down the middle-wall of partition which separated rich and poor in literature and science."

[1] See Footnote on page 61.—*I. B. B.*

[2] Dr. Neill, writing in the "Scots Magazine" in 1815, says (page 727):—"Lightfoot in his Flora Scotica mentions that truffles are found in the woods near Miggerney in Glenlyon, Perthshire, in the greatest perfection in the autumn and winter months. The late distinguished Mr. George Don, in trenching a part of his botanic garden at Forfar—it is much to be regretted that this admirable collection of hardy plants, particularly rich in alpine rarities, has, since Mr. Don's death, been entirely dissipated and destroyed—fell in with several clusters. Three years ago several detached specimens were observed on a bank at Bellevue, in the immediate neighbourhood of this city. It appears, therefore, that truffles, though perhaps not plentiful, are pretty widely distributed through Scotland.—*I. B. B.*

[3] "It seems to be remarkable that there is no monument to mark Don's grave, and we understand that steps are now being taken to do so, and that Mr. M'Nab, at the Botanic Garden is willing to receive subscriptions for the purpose."—*Mr. Neill, Biographical Notice of the late Mr. George Don of Forfar.* Apparently nothing was done in the matter.—*I. B. B.*

Postscript by Mr. A. P. Stevenson of Dundee.

Mr. Knox, in his sketch of Don, which in the first instance was communicated to the Perthshire Society of Natural Science on January 6th, 1881, pleaded strongly for some memorial to George Don, even "a simple stone to mark the spot where his ashes rest." Nothing practically was done, however, till 1902, when Mr. Knox was fortunate enough to enlist the sympathy and enthusiasm of G. Claridge Druce, Esq., the President of the Pharmaceutical Conference held at Dundee in August, 1902. Mr. Druce, in his Presidential address, dealt with Scottish Botany, and devoted a large part to George Don and his work. A movement was then inaugurated for the erection of a memorial, and the following extract from the *Dundee Advertiser* of October 17th, 1903, tells of its success :—

FORFAR.

DON MEMORIAL FUND.

A joint meeting of the members of the Field Club and subscribers to the Don Memorial was held in the Town Hall last night to consider and resolve as to the form and site of the proposed memorial. Mr. John Knox, President of the Club, who occupied the chair, gave an interesting account of the history of the movement to erect a monument to the memory of George Don, Forfar's self-taught botanist. Recently two gentlemen from Dundee—Mr. Kerr and Mr. Cumming—had called upon him (Mr. Knox), and stated that the Committee of the Dundee Pharmaceutical Conference had managed things so well that they had a surplus of £5, which they had to devote to some object, and they proposed to allocate it to the Don Memorial. He had also received £5 from the Forfar Field Club, a similar sum from the late Sir Thomas Thornton, and with other subscriptions he had now a total of £105 in his possession. The unanimous recommendation of the Field Club was that the memorial should be erected in the Reid Park, Forfar, in accordance with the practice that prevailed in other places, although, in his own view, there ought also to be some small memento placed over Don's grave in the parish churchyard. Mr. R. F. Myles moved that a Committee be appointed to wait on the Town Council in order to ascertain if they approved of the action

to erect a monument in the Reid Park. Mr. Malcolm M'Farlane seconded, and Mr. J. Watson Craik supported the proposal, which was unanimously adopted. A Committee, with Mr. Knox as Convener, was accordingly appointed to deal with the matter.

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16. NEILL, PATRICK. *Short Biographical Memoir of the late Mr. John Mackay, Superintendent of the Royal Botanic Garden at Edinburgh.* "Scots Magazine," February, 1804.

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19. NEILL, PATRICK. *Biographical Notice of the late Mr. George Don of Forfar.* Trans. Bot. Soc. Edin., vol. iv, 1850–53, p. 117. Communicated to the Botanical Society of Edinburgh, May 15th, 1851, and published in the "North British Agriculturist" for that year, and in Henfrey's "Botanical Gazette," vol. iii. (1851).

20. OBITUARY NOTICE OF DAVID DON. Proceedings of the Linnean Society, May 24, 1842, p. 145.

21. OBITUARY NOTICE OF GEORGE DON. *Ibid.*, May 24, 1856, p. xxxix.

22. SMITH, JAMES E. *English Botany.* Vols. i-xxxvi. London, 1790-1814. Figures by J. Sowerby.

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23. SMITH, JAMES E. *Flora Britannica.* Vols. i.-iii. London, 1800-4.

24. SMITH, JAMES E. *An Account of several Plants, recently discovered in Scotland by Mr. George Don, A.L.S., not mentioned in the "Flora Britannica," nor "English Botany."* Transactions of the Linnean Society. Vol. x. (1809).

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26. WATSON, H. C. *Cybele Britannica.* Vols. i-iv. London, 1847-59.

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APPENDIX A.

GEORGE DON'S REPUTED DISCOVERIES.

Having given the opinion of some of Don's contemporaries and that of his private friends, all of whom testify to his moral and truthful character, I have now to undertake a less pleasant task, owing chiefly to the remarks which in later times Dr. Walker Arnott, in the pages of "The British Flora," made upon his recorded discoveries. In the case of *Lychnis alpina* he suggests that someone, presumably Don, purposely sowed it on Little Culrannoch; but this suggestion is not borne out by the facts, while the subsequent discovery of it on another hill in Cumberland appears to leave no reasonable doubt that the plant, although very local, is indigenous to these islands. Arnott's remarks, and the list of "Reputed discoveries" at the end of Hooker's "Student's Flora," which at the time of its publication still remained unverified, would lead the imperfectly informed reader to consider Don to be an extremely careless, if not untrustworthy recorder. It must be remembered that there was little information available to give a more favourable impression, since naturally it was outside the scope of the "Student's Flora" to furnish particulars of the original discovery of the various species described, so that Don's undoubtedly good work received there no attention, and the average reader probably made an adverse judgment based upon the fact that so many plants recorded by Don still awaited confirmatory evidence of their occurrence in Britain; and I am afraid I am one of those who must plead guilty to having come to this hasty, and as I now believe, incorrect opinion.[1]

[1] The following letter bearing upon Don's discoveries appeared in the "Dundee Advertiser" of August 14, 1902:—

WILLIAM GARDINER AND GEORGE DON.

To the Editor of the Dundee Advertiser.

SIR,—Local botanists are greatly indebted to you for the excellent and lengthy report of President Druce's address on Scottish botany, especially with regard to George Don and his work. Too little is known about this Forfar "worthy." The "Dictionary of National Biography" contains the lives of his two sons, but their greater father is not inserted either in book or supplement. The papers on

It will be well to quote the opinion given by Mr. H. C. Watson in his "Cybele Britannica," since he was our best phyto-geographer, who had exceptional opportunity to form a matured judgment, and

Don's life and work by Mr. John Knox, of Forfar, and Mr. Druce are buried in the somewhat inaccessible pages of the "Scottish Naturalist," and it is a great convenience to have the report in your pages. Don's connection with Dundee is not sufficiently brought out, however. The parish of Muirhead [presumably a mistake for Menmuir], I presume, is Muirhead of Liff; but the general impression here is that Don was born in this city, where, as Professor George Lawson wrote in "Hogg's Instructor" in 1852, his father followed the trade of a currier, afterwards removing to Forfar. Don himself had many friends in Dundee; William Gardiner's father and uncle botanised with him occasionally, and the "Dundee Advertiser," in its notice of Don's death in 1814, says he was "an honorary member of the Dundee Rational Institution," a society which did much towards cultivating a taste for literature and natural science in the first decades of last century ("Scots Magazine," 1816, page 169). Don has certainly suffered in the estimation of botanists from the fact that so many of his "finds" have not been verified. Dr. Walker Arnott, of Glasgow, was probably the strongest objector. Hewett C. Watson, while inclined to put a fair amount of credence in Don's statements, points out that so careful a botanist as William Gardiner has been unable to find the stations of plants indicated by Don. Mr. Druce's examination of Don's actual specimens must add to the weight of his testimony in Don's favour. But the feeling of suspicion has long been abroad, although now and then we are gratified to see some of Don's "reputed finds" actually found in the places where he said he discovered them. The following quotation from a MS. by William Gardiner, the Dundee botanist, may well see the light now, and may throw some light on the question. In June 1831, Gardiner spent a week in botanising on the eastern coast of Forfarshire, and part of his "Journal" appeared in "Loudon's Magazine of Natural History," —the whole paper will be found in the "Botanical Repository," a manuscript magazine, now in the Lamb Collection in our Free Library. The extract I quote refers to Auchmithie:—"'Mine hostess of the great room' informed me that Mr. Drummond, of Forfar (Don's successor at Dove Hillock), used to lodge sometimes whole weeks in her house for the purpose of botanising the adjacent rocks and braes, and would rise and walk out every morning by three or four o'clock in pursuit of plants. On my mentioning Mr. Don, 'out spoke mine host,' and pronounced a warm invective against that gentleman, who, he observed, had ruined these braes, for since he had been prowling about there, not a plant worthy of notice was to be seen. I had no reason to doubt the veracity of mine host's assertion, for I have frequently searched Mr. Don's habitats in vain. I verily believe his plan respecting rare plants, was, first to dig up all the specimens he could see, and then note the locality. I highly revere the memory of my distinguished countryman, and gratefully remember how richly he contributed to my favourite science; but the above-mentioned practice is, I should think, justly deserving of censure."

In a pencil note written many years after, Mr. Gardiner says—"If true—but I now remove the censure as premature." But the paragraph stands, and is worth something towards the elucidation of some of Don's "finds."—I am, &c.,

ALEX. P. STEVENSON.

whose knowledge not only of plants, but of mankind, was very thorough. He had the critical element very largely in his composition, and he was extremely keen in detecting "errors" and "impositions," and was merciless in exposing and punishing mistakes; neither wealth nor position for a moment deterred him, and all our leading botanists at one time or another felt the smart of his lash, so that we may be sure that any opinion on Don which he may give will not be influenced unduly by mercy. This is what he says—"It appears that Don was in the habit of bringing the plants found on his excursions, into his garden for cultivation, and there can be scarcely a doubt that he occasionally gave or sold plants from his garden without explaining that they were not sent direct from native localities, but indirectly through his garden. When we add to this obvious source of error, on the part of both sender and receiver, the fact that botanists were far less particular about the nativity of specimens some half a century ago, and also that George Don, not having a scientific education, was loose even among the loose in his indications and reports of localities, the presumption of frequent errors becomes very strong. Hence I come to the conclusion that everything reported by or from Don, and remaining unverified after modern search, ought to be excluded from our list of native plants and their stations; it being safer in science to take the chance of losing a few truths of small detail, than to run the great risk of mingling many errors with our presumed facts. Still, I do not see that anything at present known of his conduct or any necessary inferences from known facts would sufficiently warrant us in charging him with intentional deception or wilful falsehood. My individual impression is that Don's reports of species and stations, though many of them were doubtless correct, cannot be safely relied upon in strict science unless confirmed afresh, but that a fair degree of moral confidence should still be given to his statement."[1]

[1] The following extracts from two letters to Sir J. E. Smith from Dr. Patrick Neill (*Smith Corresp. Linn. Soc.*), who was so good a friend to Don, have an important bearing on this subject :—

EDINBURGH, 5th November, 1804.

"On my return, some time ago, from Orkney and Shetland, where I had spent the autumn in seeing some relatives, and in pursuing natural history, I received from Mr. Don your obliging letter. I have been much occupied with business since my return, and hope you will excuse the lateness of this reply.

"The matter you refer to (respecting Mr. D[on]'s complaints on the late Mr. M[ackay] for plagiarism, &c.) is of some delicacy. I myself never heard a

After quoting this important and impartial statement by one so well qualified to judge, and remembering that it was written years ago, when few had a good word to say for Don, and before the comfirmation of several of his records had been made, I shall do well to give the list of plants said to be recorded by Don, and given as unverified by Sir J. D. Hooker in the "Student's Flora," and by other writers.

surmise of such complaints till poor J[ohn] M[ackay] had been a year in his grave, altho' several of the disputed articles had been published long before his death. In excuse for this, Mr. D. I know alleges, that he had little opportunity, in the country, of learning what was published—which is very credible, tho' not quite satisfactory. With the greatest respect for Mr. D. I must say, that he seems to me to have become rather too eager in appropriating his discoveries, and to have unfortunately fallen into a habitual inclination to detract from the merit of M., sometimes, too, in rather a rough manner. Being entirely familiar with Mr. D. I have, more than once, told him of this fault. In answer to your queries, I would say: When Mr. D. asserts a simple fact relative to himself, or that fell under his own eye (such as, that he himself found a certain plant, on a particular mountain, and on a certain date), I am convinced that you may rely implicitly on his word. But, if he speaks of things that did not fall under his own observation (such as denying that another man ever found a particular plant or visited a particular spot), I am convinced you would do well to hesitate. In short, Mr. D. is certainly a man of great integrity and veracity; but as certainly he is very liable to blunder, and I might add, to be positive.

"As far as I can recollect, the cases that seem principally dubious and on which Mr. D. most strenuously insists, are two: *Stellaria cerastoides* and *Thlaspi hirtum*. You mention, I think, that Mr. M. found *St. cerastoides* on mountains to the north of Invercauld; whereas, Mr. D. says Mr. M. was never so far north as Invercauld. May it not have happened, that Mr. M. wrote merely, that the plant was found there, without specifying by whom[1]; and may not you (as naturally you would) have taken it for granted that M. himself was the finder? You can best determine the correctness of this supposition, if you happen to have preserved his letters. You also, I believe, give Mr. M. as the discoverer of *Th. hirtum* near Perth; whereas Mr. D. alleges, Mr. M. has got his specimens out of Kinnoul garden, it having originally been found wild by the Earl's gardener in the neighbourhood somewhere. Now, who can say that Mr. M. himself did not find *Th. hirtum* in the country around Perth? From my knowledge of Mr. M. I cannot easily believe him capable of being so far led astray by a silly vanity, as directly to violate the truth. But I condemn Mr. M.'s *silence* at anyrate, in any case. Except I knew the particular cases you refer to, it is impossible for me to aid in clearing Mr. M.'s memory. I consider the plan you point out, and are following (mentioning the claims of Mr. D. and others, and saying nothing of the deceased), as by far the best one, till you have completely satisfactory evidence."

EDINBURGH, 9th May, 1806.

"I write you at present chiefly to inclose a little chapter on the natural history objects around Edinb., which I put together to oblige an acquaintance, Mr.

[1] He wrote so to Sowerby, H.S. (Note by Sir J. E. Smith).

Under each species will be quoted the opinions expressed by Dr. Walker Arnott in "The British Flora" (Ed. vi., 1850, and Ed. vii., 1855), by Dr. Boswell Syme in the third edition of "English Botany," and by Mr. H. C. Watson in the "Cybele Britannica" and its "Compendium." Reference will also be made to Sir James E. Smith's "Flora Britannica" (1800-04), "English Botany" (1795 *et seq.*), and "The English Flora" (1824-28), Hooker's "Flora Scotica" (1821), Gardiner's "Flora of Forfarshire" (1848), Babington's "Manual of British Botany" (Ed. vii., 1874), Don's

Stark. It is carelessly done, being intended merely as a sketch, and meant to be anonymous. Mr. Stark, however, wished to put in my name, which he did in his own way, without my interference, as you will readily believe from the style of flattery in it. I mention this, because, to my surprise, Mr. Don has found some fault with the mention of 5 plants in the sketch, the Edinr. habitats of which he claims as of his discovery. Altho' it is highly improbable that you should otherwise ever have heard of such a publication as the Picture of Edinb., I think it right to outrun Mr. Don's over-jealous fears, by cautioning you (and, with your permission, any botanical friend who might be writing Scottish Botany), that by mentioning *Erioph*[*orum*] *polyst*[*achyum*], *Gal*[*ium*] *pusil*[*lum*], *Valer*[*iana*] *pyr*[*enaica*], *Poa distans*, and *Hier*[*acium*] *umb*[*ellatum*], I had not intention of negativing Mr. Don's claims of discovery, and certainly none of assuming them to myself. In a second edition I can easily remove all dubiety, and will take care to do so. Indeed, *Hier*[*acium*] *umb*[*ellatum*] and *Val*[*eriana*] *pyr*[*enaica*] are already published in his Herbarium, and had I quoted any authorities I would have quoted it also. And as to *Poa distans*, Mr. D. must be in a mistake, as I find I have already mentioned it (in a review of Dr. Rotheram's nomenclature of Sir R. Sibbald's plants, published in "Scots Magazine" for April, 1802) as growing on Leith shores.

"As to *Erioph*[*orum*] *polyst*[*achyum*] and *Gal*[*ium*] *pusill*[*um*], I really would not readily have considered them as so rare plants in Scotland as to be accounted discoveries by a botanist like Mr. D., and it was mere accident that I did not rather mention such plants as *Vicia sylvatica* and *Strat*[*iotes*] *Aloides*, which would have equally answered my purpose, and certainly have procured me the same credit with the public.

"Tho' Mr. D. is a most acute botanist, I need not tell you how very confused and inaccurate a writer he is, nor how much labour it has given me to extract the habitats and observations which appear in his 5 published fasciculi. They are not yet correct; but they would certainly have been infinitely worse had I not transcribed the greater part. I cannot help considering his conduct to me, therefore, as partaking not a little of ingratitude. But much delicacy of feeling ought not, perhaps, to be expected from one who has had few opportunities of improvement—(you must understand that he accused me to one or two of my acquaintances, and without speaking to myself, of "robbing" him of his discoveries). His conduct to myself on this trifling and unexpected occasion, convinces me more and more of the justness of my estimate of his violent complaints against the late Mr. Mackay."—*I. B. B.*

"Herbarium Britannicum" (1804-12), and his herbarium, and to Don's plants in the possession of Miss C. E. Palmer of Odiham, sent by him to her grandmother, the fourth Countess of Aylesford, circa 1804-10.

Ranunculus alpestris, *L.*

"By the sides of little rills, and in other moist places, about two or three rocks on the mountains of Clova, Angusshire, very rare, and but seldom flowering." Mr. Don suggests that "its herbage bearing a great resemblance to several of its kindred, may easily have been overlooked, but when in blossom it is truly a splendid plant." Smith in Trans. Linn. Soc., x., p. 343 (1811). Smith's paper was read in 1809. "Mr. Don informs us it rarely produces flowers where he observed it, and that the plant itself is not plentiful . . ." Sm. in Eng. Bot., t. 2390 (1812).

"Appears to have been from Don's garden." Hooker and Arnott, Brit. Fl., Ed. vi., p. 9. "A specimen from Don . . . marked . . . 'near the head of Clova,' has the aspect of a wild one." *Id.* Brit. Fl., Ed. vii., p. 9.

"Clova Mountains, G. Don, in Herb. Smith, now generally excluded from our flora." Watson, Comp. Cyb. Brit., p 477.

"Incognita. It is difficult to decide under what category of citizenship . . . this alpine *Ranunculus* ought to be placed. The existence of a specimen in the Smithian herbarium, with a memorandum that it was collected in Forfarshire by Mr. George Don, seems very good evidence in favour of its nativity; and yet no other botanist among the many who have searched the mountains of that county has ever detected an example of this species there. Moreover its geographic distribution otherwise would not much incline us to expect the species in Scotland; since it is not found in Scandinavia, nor any of the arctic lands. At the time when Mr. Don was a collector, it was not the custom with botanists to be very particular in recording the locality and distribution of plants; and they might not always be sufficiently careful in keeping British and foreign, wild and garden examples of the same species, apart from each other." Watson, Cyb. Brit., i., p. 82.

"No doubt Mr. Don made some mistake in thinking he found it there." Syme, Eng. Bot., i., p. 70.

After Don's precise statement, it appears very difficult to believe he was in error. It must be remembered that hardly any competent botanist has visited the Clova mountains at so early a date as the plant flowers to make a systematic

search.[1] . The only alternative to me seems that Don might have gathered a specimen of the Batrachian group, and planted it in his garden, where he afterwards confused it with *R. alpestris*, but from Smith's specimen being in flower it does not appear probable unless Don sent to Smith on April 3rd a specimen from his garden. The date is early for a plant to flower in high altitudes, the chief Continental floras giving June and July as the date of flowering.[2] The Continental distribution as given by Nyman in his "Conspectus," is the Pyrenees, Jura, Alps, and Carpathians.

Caltha radicans, *Forster.*

"Forfarshire, Don (known now in cultivation only)." Hooker, Student's Fl. (1870), p. 9.

"Mr. T. F. Forster, who first defined this species of *Caltha*, . . . favoured us with this specimen from his garden, which agrees with wild ones sent by Mr. G. Don from Scotland, except that in the latter the stems are more erect. Mr. Forster's plant was found in Scotland by Mr. Dickson." Smith, Eng. Bot., xxxi., t. 2175 (1810).

"*C. radicans* may be retained as a book species, 'in compliment to its author'; but it is no species in nature, apart from *C. palustris*. Hooker correctly places the one as a variety of the other." Watson, Cyb. Brit., i., p. 93.

"Province 15, in a ditch, Carse, Forfar, 1790, G. Don." Watson, Comp. Cyb. Brit., i., p. 477.

See also Babington, Man., Ed. vii., p. 12 (1874).

"*Var. β. radicans*, Hook. 'In a ditch that runs from the farm-house, called Haltoun, on the estate of C. Gray, Esq., of Carse, Forfarshire, 1790, Mr. Geo. Don.' No other botanist has, I believe, found this plant, but if the station is not destroyed, future research may determine whether it is not identical with *C. palustre*, *β. minor*, the alpine state of the common plant." Gardiner, Fl. Forfar., p. 5.

"Is only known, and in our opinion has never been known, except as a garden variety." Hooker and Arnott, Brit. Fl., Ed. vi., p. 11.

[1] This requires ualification, as Scottish botanists know. The following excerpt bears witness to search at a time when the plant might have been in flower :—"Dr. Graham starts about the end of April for the mountains of Clova with a small party in quest of some of the spring flowering plants said to have been found by the late G. Don, such as Tussilago alpina, Hierochloe borealis, and Eriophorum alpinum, &c." *Winch Corresp. Linn. Soc.* ; *James Macnab to N. J. Winch, 23rd April, 1834.—I. B. B.*

[2] In the Royal Botanic Garden plants grown in frames do not flower earlier than May.—*I. B. B.*

"*C. radicans* sub-species." Syme, Eng. Bot., t. 41. The "radical" leaf added by J. E. Sowerby from Eng. Bot., t. 2175.

Arnott's statement, positive though it be, is wrong. There were wild examples existing in the Smithian and British Museum Herbaria, and it appears that Don suggested the name *C. denticulata* for it to Smith. The plant has been rediscovered near Rescobie by Mr. W. Graham, and I have also seen it in Inverness-shire near Loch Morlich, in south Aberdeenshire near Invercauld, in Ross-shire at Dundonnell, and in Caernarvonshire at Llanberis. It is probably widely spread. The plate of it in the Linnean Transactions is perhaps the reason why it is not more generally recognised, from the fact that the leaf which is figured, is assumed to be one of the radical leaves of the main stem. I think it is a lower leaf from one of the rooting nodes of the stem, as these usually present the triangular outline, whereas the real radical leaf is only rarely of that shape. The chief characters appear to me to be the uniformly rooting stem, and the narrower sepals. It is always found in shady places, growing in rich mud, and usually at the base of high mountains, or in sub-alpine localities.

Rapistrum orientale, *DC.*

"Prov. 15. Forfarshire; G. Don, the sole authority. Error?" Watson, Cyb. Brit., i., p. 136. "'The Myagrum orientale' of Don's [Forfarshire] list." Watson, Comp. Cyb. Brit., p. 482.

A plant of casual occurrence only, which has been found in other parts of Britain introduced with corn or ballast from southern and eastern Europe.

Arabis ciliata, *R. Br.*

"Incognit. in Scotland. The late George Don found an *Arabis*, which he calls '*Turritis nov. sp.*,' near Loch Lee, in Glen Esk, growing on rocks; and he states that Mr. J. T. Mackay recognised it as the same which he had found in Ireland . . . In 'Flora Scotica' the Glen Esk plant is referred to *A. ciliata*, but it does not appear that the author had seen specimens from Don. The probability seems strong that *A. hirsuta*, which occurs on the mountains of Forfarshire, was mistaken for *alpina* or *ciliata*." Watson, Cyb. Brit., i., pp. 142-143.

"On rocks in Glen Esk, Loch Lee, 1801, Mr. G. Don. This rare rock cress Mr. Don considered to be a new species at the time of its discovery, but Mr. J. T. Mackay, on a visit to him in 1811, identified it as the same he had gathered in Ireland, and Sir James E. Smith pointed out its synonym." Gardiner, Fl. Forfar., p. 14.

The specimen in Miss Palmer's collection labelled in the Countess of Aylesford's handwriting *Turritis alpina* is from

the Glen Esk locality, being sent in the fresh state by Don. It is neither *A. ciliata* nor *A. alpina*, but a form of *A. hirsuta*, though more glabrous than usual. The error in identifying it with the Irish *ciliata* appears to be due to Mackay and Smith and not to Don.

Silene alpestris, *Jacq.*

"A specimen of this plant gathered by Mr. G. Don 'on a rock on a mountain to the east of Clova, Angusshire,' is in Mr. Borrer's Herbarium," (Babington, Man., Ed. vii., p. 51). Watson, Cyb. Brit., i., p. 203. Gardiner, Fl. Forfar., p. 27. *See also* Syme, Eng. Bot., ii., p. 134.

"They appear certainly . . . obtained from a garden." Hooker and Arnott, Brit. Fl., Ed. vi., p. 59.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 475.

"Prov. 15. Forfar; 'G. Don in Borrer Herb.' Error?" Watson, Cyb. Brit., i., p. 203. "Specimens from Don are now distrusted." Watson, Comp. Cyb. Brit., p. 490.

A very unlikely plant to be found in Forfarshire. Don never published a record of it himself, nor have I seen a specimen labelled so by him.

Arenaria fastigiata, *Sm.*

"Mr. George Don had the good fortune to discover this new British plant on rocks in the mountain of Clova, Angusshire, and also in Fifeshire. He rightly referred it to Jacquin's *A. fasciculata*." Smith, Eng. Bot., xxv., t. 1744 (1807).

It was previously distributed by Don in "Herbarium Britannicum" No. 136, where Don says, "It is several years since I first observed this plant . . . [in] Clova, but very rare, . . . I have likewise found it on some rocks in Fifeshire, but rare. My specimens are from Clova."

Alsine fastigiata, Bab. "Prov. 15. Forfar; Fife; G. Don. Error?" Watson, Cyb. Brit., i., 220. "Dr. Arnott intimated in the 'British Flora' that he was in possession of Clova specimens 'from Drummond,'" . . . Watson, Comp. Cyb. Brit., p. 491.

Drummond was . . . Don's successor at Forfar, and he may have possibly sent them from Don's garden.

"Though it has been found by no botanist at present living, it would scarcely be proper to omit it from the list of British plants. I have one of Don's specimens; this has no particles of mica adhering to the roots, as most frequently happens with plants gathered on the Clova mountains, where it purports to have been gathered." Syme, Eng. Bot., ii., pp. 114 and 115.

Neither the specimen in Miss Palmer's collection nor that in the "Herbarium Britannicum" has any mica adhering to the roots. Arnott, in the "British Flora," says that he has specimens from Drummond as well as Don; so that some corroboration exists, although not of an entirely satisfactory character, since Drummond may have sent them from the Forfar garden.

The plant named *Arenaria fastigiata* by Smith is the *Alsine Jacquini*, Koch.

Sagina alpina, *Druce*, in the "Scottish Naturalist," p. 177 (1884).

"Top of Ben Nevis, Don." Hooker, Student's Fl. (1870), p. 61 [as a var. of sub-sp. *S. maritima*].

"Prov. 16. Summit of Ben Nevis; G. Don. Apparently not found by any living botanist, and the summit of Ben Nevis is almost destitute of phænogamous plants." Watson, Comp. Cyb. Brit., p. 490.

"Don seems to have found it on Ben Nevis." Bab. Man., Ed. vii., p. 53.

See also S. maritima Don, *var. alpina*, Syme, Eng. Bot., ii., p. 117.

Doubtless Don found this plant on Ben Nevis in 1794, for, as Mr. Watson elsewhere asserts that with Don the "summit of mountains" means "declivities many feet below," the fact that the summit of Ben Nevis is almost destitute of phænogamous plants does not disprove Don's assertion. It was my good luck in company with Mr. E. Robertson of Burnside, Forfar, to find a *Sagina* in the upper part of Corrie Sneachda, and on the high rocks between the head of Loch Aan and Ben Mac Dhu, which Mr. Arth. Bennett says he cannot keep apart from Don's plant. *See* Annals Scott. Nat. Hist., p. 273 (1892).

Stellaria scapigera, *Willd.*

"Sides of rivulets on the mountains of Badenoch, between Loch Ereachd (Ericht) and Loch Laggan; and by the side of a rivulet on a mountain to the eastwards of Loch Nevis, Inverness-shire." Don, Herbarium Britannicum, No. 10 (1804).

"Wild specimens of this new and curious *Stellaria* have been obligingly communicated to us by Mr. G. Don, who gathered them at different times of the year 1794 to 1803 . . . The plant was received by the younger Linnaeus from the Kew garden . . . but its native country was altogether unknown till Mr. Don's fortunate discovery." Smith, Eng. Bot., xviii., t. 1269 (1804).

"*S. scapigera* . . . is apparently a monstrosity of *S. graminea*, and probably from Don's garden; some plant he met with being mistaken by him for the same as the one he had in cultivation." Syme, Eng. Bot., ii., 99.

"We now believe [the] plant to exist nowhere in a wild state, but to be a mere cultivated form of *S. graminea*. Don cultivated it extensively in his garden at Forfar. . . . It was originally described by Willdenow from a plant in the Berlin gardens, who does not say from whom it was received; but it is not even conjectured to have been from Scotland, and has not been found anywhere else. It . . . increased by division, but not by seed, although seed is produced sometimes freely. In the Glasgow Botanic Garden, . . . *S. graminea* [springs] up in the vicinity of pots in which *S. scapigera* [has been] cultivated." Hooker and Arnott, Brit. Fl., Ed. vii., p. 70.

"According to Boswell Syme this is 'apparently a monstrosity of *S. graminea*'; whereas Prof. Babington 'can scarcely believe this is a state of *S. graminea*.' Prof. Arnott says its seeds produce *S. graminea*." Watson, Comp. Cyb. Brit., p. 492, and Cyb. Brit., i., p. 225.

There need be little doubt that Don found it in the wild state and brought it to his garden. I can find no evidence to support Arnott's statement that it was extensively cultivated there. It should be noted that Arnott does not state positively that its seeds produce *S. graminea*, but merely that *S. graminea* comes up in the vicinity of *S. scapigera*, which does not produce itself from seeds. Surely Arnott with his opportunities ought to have been able to say positively whether or no seeds of *S. scapigera* did or did not produce *S. graminea*. If they did, it does not negative Don's statement that he found it wild. *S. scapigera* is, I believe, a monstrous condition of *S. graminea*, but it must have originated somewhere, and quite as likely on a highland moorland as in a lowland garden, and it was Willdenow, not Don, who gave it specific rank.

Lychnis alpina, *L.*

"Mr. G. Don . . . first made this interesting discovery, on rocks near the summit of Clova mountains . . . in August, 1795. The plant is there very scarce, being only found . . . on the most elevated spots . . . We have preferred drawing Mr. Don's original specimen, though dry, to any garden one." Smith, Eng. Bot., t. 2254.

"This interesting plant was first discovered on [Little Culrannoch] by the indefatigable G. Don." Gardiner, Fl. Forfar., p. 28.

"We have strong reasons for thinking that the plant was sown there [on Culrannoch] about sixty years ago." Hooker and Arnott, Brit. Fl., Ed. vi., p. 61. Although the name of Don is not mentioned, from the date being put to Don's time, it evidently is meant to suggest him.

"Discovered by the late G. Don . . . and found by Dr. Graham and others on the summit of a hill called Little

Kilrannoch, between Glen Prosen and Glen Callater. Dr. Graham estimated the hill at 3200 feet. It was pointed out to me by a shepherd from the head of Canlochen Glen, and at that distance I thought it scarcely above 3000 feet." Watson, Cyb. Brit., i., p. 204.

The plant still grows there—but the elevation is only about 2700 feet—and is native, as it is on Hobcarten fell, Cumberland. It is one of Don's indisputable discoveries.

Hypericum barbatum, *Jacq.*

"By the side of a hedge, near the wood of Aberdalgy, in Strathearn, Perthshire, Mr. G. Don." Smith, Eng. Bot., t. 1886; *Id.*, Eng. Fl., iii., p. 329.

The specimens sent by him were in a sufficiently fresh state to be drawn for Eng. Bot.

"We do not believe that this species was found wild in Scotland." Hooker and Arnott, Brit. Fl., Ed. vi., p. 81.

"In English Flora, Smith accepts this as a true native, and without a word of doubt; attributing it to 'bushy places in Scotland' as though there were any number of localities for it in addition to the one specially mentioned 'by the side of a hedge' in Strath Earn. Smith was too exclusively a botanist of the study, not of living nature in the wild, to warrant any reliance on his decisions about the genuine nativity, or otherwise, of plants in Britain." Watson, Comp. Cyb. Brit., p. 494. *See also* Cyb. Brit., i., p. 254.

"Perthshire, Don; never confirmed." Hooker, Student's Fl. (1870), p. 476.

"No one has found it since; and if it ever occurred there it was doubtless an escape from cultivation, as it is most unlikely that an Austrian plant, not occurring in Scandinavia, France, or North Germany, could be wild in Scotland." Syme, Eng. Bot., ii., p. 160. *See* Babington, Man., Ed. vii., p. 67.

A specimen is in Herb. Palmer. Don doubtless found it as described by him, but only as an escape from cultivation. It belongs to the same grade of citizenship as *H. hircinum*.

Potentilla tridentata, *Ait.*

"Justly reckoned by Mr. Don among the most beautiful of its genus, was gathered [by him] on a mountain called Werron in Angusshire." Smith, Eng. Bot., t. 2389. *Id.* in Trans. Linn. Soc., x., p. 343 (1811).

"On a mountain called Werron, and some other hill in Angusshire to the westward, Mr. G. Don." Smith, Eng. Fl., ii., p. 424.

"This hill has since been searched by Mr. Kerr and a party from Montrose, but without success. It may, however, have occurred only in one spot; and such a spot may elude again and again the keenest researches of the mountain rambler. An authentic specimen gathered by Don, is in Mr. Kerr's herbarium; and there is a specimen among the remains of an herbarium formed by Mr. Douglas Gardiner in 1813, which had likely been given to him by Don, as they were intimate friends." Gardiner, Fl. Forfar., p. 61.

"Clova Mountains, Don; never confirmed." Hooker, Student's Fl. (1870), p. 476.

"Werron Hill, Clova, G. Don; but found by no one else." Hooker and Arnott, Brit. Fl., Ed. vi., p. 124.

"Incognit. The late Mr. G. Don appeared quite confident that he had seen or collected this species in Forfarshire; and there is even a specimen preserved in Smith's herbarium, which is labelled as though actually collected on the mountain of Werron in that county, by Mr. Don, with the date of April 3, 1809. Is it possible that Mr. Don could have mistaken plants of *Sibbaldia procumbens* or *Potentilla Fragariastrum* for this species, and have sent or pointed out to Smith an example of *P. tridentata* as being the same species as that which he had seen on Werron and other hills? I do very much suspect that this is the true solution of some of the mystery or uncertainty which attaches to several of Don's habitats; namely, that, intending to send or show the same species, he or Smith inadvertently confused it with some other species." Watson, Cyb. Brit., i., p. 348, and iii., p. 418; also Watson, Comp. Cyb. Brit., p. 501.

"Said to have been found by Mr. G. Don on Werron Hill and East Rocks, Loch Brandy, Clova; but no doubt *Sibbaldia procumbens* has been mistaken for this American plant." Syme, Eng. Bot., iii., p. 260, and Babington, Man., Ed. vii., p. 103.

At a meeting of the Edinburgh Botanical Society, March 14, 1850, Mr. M'Nab exhibited a dried specimen of *P. tridentata* sent by Mr. Westwood, of the Botanical Garden, Dollar, as a part of a plant picked by him and Mr. Stewart on Ben Wyvis, about ten years before.

The only way in which Don could have possibly mistaken this species for *Sibbaldia* was in gathering some young or abnormal form of *Sibbaldia* out of flower (as it would be so early in the year) and planting it in the *Potentilla* bed in his garden, subsequently confusing it with *P. tridentata*; but this explanation requires one to assume such an amount of ignorance on the part of Don, that I feel the greatest difficulty in adopting it. In his original record Don speaks with no uncertainty respecting it and points out that its beautiful white flowers at once distinguish it; and one must also bear in mind

that to Don *Sibbaldia* must have been one of the commonest plants, and must have been known to him in its varied forms. Surely one who could differentiate the forms of the cut-leaved Saxifrages, and of the alpine Poas and Airas, could never have confounded those two plants. It is a curious coincidence that both *P. tridentata* and *Ranunculus alpestris* are said by Don to have been gathered on the same day, namely April 3, 1809, a date on which I venture to think no other capable botanist has ever visited the higher hills of the Clova district;[1] but I must confess the occurrence, as a native plant, of either of the two species, appears, with our present knowledge of phyto-geography, as most improbable. Could the date quoted above be the date on which Don gathered the two species in his garden and sent them to Smith?

Potentilla opaca, *Sm.*

"I discovered this plant some years ago on the mountains of Angusshire to the west of Clova. I likewise observed what I take to be the same plant on rocks opposite Dundee, in April, 1786. I was at a loss as to this species, till I happened to notice the figure in Jacquin's Pl. rar. ic. cent. i., t. 91, which exactly agrees with my plant." Don, Herb. Brit., No. 165.

"Mr. Donn of Cambridge . . . has received from Scotland the true *opaca*." Smith, Eng. Bot., t. 2449.

Presumably it came from Don.

"*P. opaca*, Clova mts., Don; never confirmed; but the specimens are *P. intermedia* [Nestl]." Hooker, Student's Fl., (1870), p. 476.

"*P. opaca*, Linn. Incognit. Hills of Clova and Braes of Balquhidder, G. Don. Repeatedly as the hills of Scotland have been searched by the best collecting botanists of Scotland and England since the time of Don, this species had not again been found." Watson, Cyb. Brit., i., p. 345. Watson, Comp. Cyb. Brit., p. 501.

"Received from Scotland by the late Mr. Donn of Cambridge. Said to have been found on the hills of Clova, Angusshire, as well as in Perthshire, by Mr. G. Don." Smith, Eng. Fl., ii., p. 423. *See also* Hooker, Fl. Scot., p. 163. D. Don in Mem. Wern. Soc., iii., (1821), p. 305.

"*P. intermedia*, Nestl. Said to have been found by Mr. G. Don . . . but not found by any other botanist, and his authority alone is not sufficient to establish its occurrence." Syme, Eng. Bot., iii., p. 260. *See* Babington, Man., Ed. vii., p. 102.

Mr. David Don, son of Mr. George Don, says that the *Potentilla* was first discovered by his father, and that he himself saw specimens when they were freshly brought from

[1] See footnote on page 98.—*I. B. B.*

their native habitats, and his description is drawn up from specimens in his father's herbarium. David Don was only 15 or 16 years old at his father's death, and he appears to be the authority for his father finding it on the Braes of Balquhidder. The specimens in Don's Herbarium Britannicum are certainly not the true *P. opaca*, and are, as Sir Joseph Hooker points out, *P. intermedia*, Nestl., not of Linn., the *P. Nestlerana*, Tratt., which Nyman puts under *P. heptaphylla*, Miller. The figure in Jacquin's "Icones" referred to by Don is poorly drawn and badly coloured, and as Don says he saw the plant on the Clova hills "some years ago," I think in this case there has been a confusion with his garden specimens, since the plant distributed by Don and that figured by Smith from the Cambridge gardens, doubtless supplied by Don, are the same thing.

Under *P. opaca* Nyman in his Conspectus gives Scotia, Scandinavia, Dania, Germania, &c., but the true *P. opaca* (which is not an unlikely plant to occur) has not been recorded except in error. *P. intermedia*, Nestl., is quite unlikely to occur in Britain except as an alien.

Sanguisorba media, *L.*

"*Sanguisorba media*. In pastures, in the West of Scotland. Mr. G. Don. Taller and larger than the foregoing, with a much longer and truly cylindric spike of paler flowers. Mr. Don, who sent it, had scarcely an idea of its being more than a variety. Yet it is certainly the plant of the authors quoted [Linnæus, Willdenow, Aiton], and is found wild in Siberia as well as in Canada." Smith, Eng. Fl., i., p. 219.

"*S. (officinalis) media*, Don (not Linn.). Prov. 13 or 16. West of Scotland; G. Don. Syn. 354." Cyb. Brit., i., 360. "A variety of *S. officinalis*, Mr. Borrer." Watson, Comp. Cyb. Brit., p. 509.

"Incognit. Stated to have been found by Mr. George Don in the West of Scotland; but some variety of the British species, *S. officinalis*, would seem to have been mistaken for the American plant." Watson, Cyb. Brit., i., p. 360.

"One of Don's reputed discoveries; not confirmed." Hooker, Student's Fl. (1870), p. 476.

Mr. Borrer says he has Don's specimens.

"Said to have been found by Mr. George Don in the West of Scotland, but doubtless erroneously, as it is an American plant not occurring at all in Europe." Syme, Eng. Bot., iii., p. 260.

Syme repeats a misstatement when he says that Don said he found *S. media*. He did nothing of the kind. He "had scarcely an idea of its being more than a variety" of [*S.*

officinalis], as will be seen from the last paragraph in Smith's description, which enables us to absolve Don either from falsely recording a plant which does not occur in Scotland, or misnaming *S. officinalis* as *S. media*, which Hooker in the Student's Flora says is one of Don's "reputed discoveries, not confirmed." The old adage, "give a dog a bad name," is well exemplified in the case of Don, for Smith's numerous errors as well as Drummond's slips are fathered on Don. Mr. Watson is himself guilty of making a man say what he has not said when he writes "*S. media* Don, not of Linn." The true reading should be "*S. media* Sm., not of Linn." A form of *S. officinalis* sent from the West of Scotland by Don was mistaken by Sir J. E. Smith for the North American species. Don himself identified it as being a variety of *S. officinalis*.

Alchemilla conjuncta, *Bab.* (**A. argentea**, *G. Don*).

"Clova mts. Mr. G. Don. A specimen is in Mr. Borrer's herbarium, but I have never been able to recognise it among the hundreds of specimens of *A. alpina* examined for that purpose." Gardiner, Fl. Forfar., p. 64.

(Area. 12**15) Incognit.? Said to have been collected . . . on the Clova mountains. Mr. Don's specimens are still in herbaria; but I suspect some mistake, the specimens appear so like those from gardens." Watson, Cyb. Brit., i., p. 363, iii., p. 423.

"George Don distributed examples from the Forfarshire hills ostensibly; but Don habitually sent garden examples of supposed wild plants, so that his testimony alone goes for nothing. Mr. A. O. Black also reported the plant from Forfarshire, and showed examples; but Mr. Black was convicted of reporting a planted American shrub, as if also a true native of that county; so that in relying on his testimony we ought to include the *Diervilla canadensis* among truly British plants now and for ever." Watson, Comp. Cyb. Brit., p. 470 (1870).

Professor Babington informs me that he has specimens of the true plant from Mr. A. O. Black in Glen Dole, and that most of the garden plants originally came from Don. The exact station given by Black is "about 300 feet from the base of Glen Dole, on the left hand side of the first large ravine which comes down from Craig Rennet on entering Glen Dole."

The plant still awaits discovery, and Mr. Watson is a little unfair in his judgment of Mr. Black, who of course was not an authority on the indigenity of plants, and described the Canadian shrub as *native*, when he meant *wild*, but this unfortunate expression does not necessarily throw a doubt on his *bona fides* regarding the record of *Alchemilla*, which may be held to support Don's statement. A point has been raised by

my lamented friend Henry Boswell, namely, that plants of *A. alpina* which he brought from Ben Lawers changed under cultivation into *A. argentea*, and the specimens which he showed me were certainly the latter; but Mr. Arthur Bennett controverts the statement, and I should not think it probable. Syme points out that *argentea* grows much more readily in gardens about London, but that *alpina* exists only under special treatment. It is easy for one garden plant to take the place of another so that the usurper is thought to be the original occupier, and Don himself may have been the victim of the same misconception as Mr. Boswell.

A. argentea is known from the Faroe Islands, and Nyman also gives Scotia and Isle of Arran, and it has been reported from Cumberland, but only on faith of a record by Mr. Bowman and of garden plants said by the distributor, the Rev. R. Wood, to have been originally brought from Borrowdale, but no one has confirmed the discovery. Dr. Tyacke also says he found it in Glen Sannox, Isle of Arran. *See* Syme, Eng. Bot., iii., p. 139, t. 424. Syme says a portion of one of Black's specimens is only *A. alpina*, and the other portion approaches *A. alpina*.

Saxifraga muscoides, *Wulf.*

"*S. moschata*, Sm. Mr. Don [Donn] of Cambridge [has] given us specimens from his garden, the parent roots of which he received from the Highlands of Scotland." Smith, Eng. Bot., t. 2314.

"Prov. 12? . . . 'Highlands' . . . Error. Cyb. Brit., i., p. 415." Watson, Comp. Cyb. Brit., p. 517.

"One of Don's reputed discoveries; and reported from Westmoreland by Hudson." Hooker, Student's Fl. (1870), p. 477.

The only record made by Don is in Headrick's View of the Agriculture of Forfarshire, in which he records "*Saxifraga, nova species*, which I believe to be the *S. muscoides* of Willdenow." This is evidently a mistake on Don's part, as this saxifrage is not likely to be found in Scotland, its European range being according to Nyman, "Pyren., Arvern., Juras, Alpes, Appen." Don's record, it will be observed, is by no means positive. A more correct statement would be "A form of *S. hypnoides* from the mountains of Forfar was erroneously thought by Don to be the *S. muscoides* of Willdenow."

Saxifraga pedatifida, *Ehrh.*

"Mr. G. Don and the late Mr. J. Mackay both gathered this plant in the Highlands, the former on the mountains of Clova, Angusshire. Our figure is unavoidably taken from a garden

specimen." Smith, Eng. Bot., t. 2278. *See also* Trans. Linn. Soc., x., p. 340 (1811).

"Rocks near the head of Clova, Mr. G. Don." Gardiner, Fl. Forfar., p. 77.

"Native? Rupestral. Said to have been found by Mr. Don on rocks near the head of Clova. In his account of the botany of Forfarshire [Headrick, Agric. Forfar.] Don says, in his usual vague or careless language, 'summits of the Clova mountains,' but with him the 'summits' sometimes mean declivities very far below, and usually intend the rocks at 700 to 800 yards. The actual summits are 1000 yards or upwards, though there are peaks and ridges of only 800 or 900 yards." Watson, Cyb. Brit., i., p. 417.

"'Don does not pretend to have found it, but sends a garden specimen, saying he has heard it has been found in Scotland.' Dr. Boswell Syme, letter, 1864." Watson, Comp. Cyb. Brit., p. 518.

"Said to have been found by Mr. Don on rocks by the head of Clova; also reported to have been gathered in the Isle of Achill, . . . but there seems no satisfactory evidence of the latter being the true plant." Syme, Eng. Bot., iv., p. 87.

Syme apparently thought that Don's was the true plant, and he does not here refer to Don having sent a garden specimen to Smith as Mr. Watson quotes in the Compendium of the Cybele, p. 518.

"One of Don's reputed discoveries; his specimens are the common garden *S. trifurcata*." Hooker, Student's Fl. (1870), p. 477.

This species is given by Nyman only from Spain.

One fact will be observed in all these notices except the first, namely, that in each the name of that brilliant and accurate explorer Mr. J. Mackay is omitted, but the merit or the odium as much attaches itself to him, as to Don, since he also sent Smith a record of having found it in the Highlands.

Chærophyllum aromaticum, *L.*

"I discovered this in 1810, by the side of the river called Lunan and Vennie, not far from Guthrie, in a truly wild state, Mr. G. Don." Gardiner, Fl. Forfar., p. 85.

"Discovered by the late Mr. George Don near Guthrie, about seven miles east from Forfar, near the margin of the road leading from Forfar to Arbroath. *See* Trans. Wern. Soc., iii., p. 300 (1821)." Eng. Bot. Suppl., t. 2636 (1830). Smith, Eng. Fl., ii., p. 53.

"Prov. 15, Forfar; G. Don, sole authority? Error. Cyb. Brit., i., p. 463." Watson, Comp. Cyb. Brit., p. 520.

"Scotland, Don; not confirmed." Hooker, Student's Fl. (1870), p. 477.

Mr. David Don says he saw the specimen when brought home by his father, as in the case of the supposed *Potentilla opaca*. I have no doubt that Don found this plant as a casual, since, although it has a wide European distribution, it is not likely to be native in Britain. There is a specimen in Herb. Palmer.

Chærophyllum aureum, *L.*

"I discovered this rare plant several years ago, by the sides of cornfields between Montrose and Arbroath. I afterwards found a few plants near Corstorphine, within four miles of Edinburgh. I observed what I believe to be an intermediate plant between this and the *C. sylvestre*, near the village of Kirkliston, about ten miles west from Edinburgh." Don, Herb. Brit., No. 207. *See also* Smith, Eng. Bot., t. 2103 (1810), and Trans. Linn. Soc., x., p. 339 (1811). Don, in Headrick's Agric. Forfar.; Herb. Palmer; Gardiner, Fl. Forfar., p. 85.

"Provinces 14-15, Edinburgh and Forfar; G. Don only Error or casual. Cyb. Brit., i., p. 463." Watson, Comp. Cyb. Brit., p. 520.

"Mr. G. Don; not found since." Syme, Eng. Bot., iv., p. 180.

"Scotland, Don; not confirmed." Hooker, Student's Fl. (1870), p. 477.

A plant of casual occurrence for which Nyman gives a wide distribution through central and eastern Europe, but says has also been found adventitiously in Norway, as doubtless were Don's plants in Scotland. I have found a solitary specimen of a yellow-flowered Umbellifer, which I think is a *Chærophyllum* but not *aureum*, near a mill in Berkshire, but at present I have not been able to identify it.

Galium cinereum, *Sm* (**G. diffusum,** *D. Don*).

G. diffusum, D. Don, ined. Near Kinnaird, Angusshire. G. Don." Hooker, Fl. Scot., p. 52.

"On the banks of the river Leith, near Slateford, three miles E. from Edinburgh. Mr. G. Don." Smith, Eng. Fl., i., p. 203. *See also* Eng. Bot. Suppl., t. 2783 (1834).

G. diffusum, Hook. *G. cinereum*, Sm. . . . Of this I have only seen the solitary specimen from Don contained in Smith's herbarium . . . It must be considered as a very doubtful native, as no one but Don has found it." Syme, Eng. Bot., iv., p. 215, t. 648 bis.

"Edinburgh and Forfar; G. Don. Ambiguity. *See* Eng. Bot., iv., p. 216. Eng. Fl., i., p. 203." Watson, Comp. Cyb Brit., p. 521.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 477.

A better definition would be a casual plant formerly found by G. Don in Edinburgh and Forfar.

G. aristatum, *Sm.*

"In Angusshire, but not common. Mr. G. Don." Smith, Eng. Fl., i., p. 203.

"This new addition to our Flora, sent by the late Mr. Don as *G. erectum*, is undoubtedly the original *G. aristatum* described by Linnæus." Smith, Eng. Fl., i., p. 203. *See also* Eng. Bot. Suppl., t. 2784 (1834).

"Probably a state of *G. erectum*." Babington, Man., Ed. vii., p. 170.

Given as a synonyn of *G. erectum* in Hooker's Student's Fl. (1870), p. 178.

"*G. erectum* var. *aristatum*, Bab. Evidently one of the intermediate forms which connect the two sub-species." Syme, Eng. Bot., iv., p. 217, t. 649 bis. *See* Watson, Comp. Cyb. Brit., p. 522.

This is another instance where Smith has fallen into an error, as the plant is not the *aristatum* of Linnæus. Don was correct in referring it to *G. erectum*, to which it is closely allied. There is great probability of the plant being again found.

Galium spurium, *L.*

"I first observed this plant in 1784, in cornfields near the village of Redditch in Worcestershire . . . I next observed it in 1801, in cornfields near the village called Lochhead, about two miles from Forfar, but not common. Dr. Smith, who had the goodness to compare specimens of this *Galium* with the Linnean Herbarium, found that my plants agreed in every respect with the Linnean specimen." . . . Don, Herb. Brit., No. 104.

See also Smith, Eng. Bot., t. 1871 (1808), and under *G. tricorne*, t. 1641 (1806); Gardiner, Fl. Forfar., p. 93; Herb. Palmer; Hooker, Fl. Scot., p. 50.

"Mr. G. Don is said to have discovered [it] in Forfar, and a specimen is preserved in Smith's herbarium; but Mr. Gardiner appears not to have found the same species in that county." Watson, Cyb. Brit., ii., p. 20.

"Casual." Watson, Comp. Cyb. Brit., p. 522.

"Scot. (*r*), Angl., Scand., med. mer., Germ., Belg., Gall., etc." Nyman, Consp., p. 330.

A casual plant which I have found on waste ground near Oxford.

Galium saccharatum, *All.*

"*G. tricorne.* In cornfields, but rare. I have observed it in the Carse of Gowrie. It has likewise been observed in cornfields near Malton, in Yorkshire, by . . . Mr. R. Miller." Don, Herb. Brit., No. 103.

"*G. verrucosum.* Whether this species of *Galium*, confounded by almost all our botanists with our *tricorne*, has ever been gathered in Britain before Mr. Don observed it in cornfields near the Carse of Gowrie, we have no means of knowing." Smith, Eng. Bot., sub. t. 2173 (1810).

"Mr. Borrer writes that his 'specimen from G. Don is like that figured in Eng. Bot. as *G. verrucosum*.' And as that figure appears to have been taken from a true example of *G. saccharatum*, it would seem that the species had been really found in Britain; though, if so, it was doubtless as a casual introduction only." Watson, Cyb. Brit., iii., p. 449. Watson, Comp. Cyb. Brit., p. 522.

"Probably introduced with seed corn." Hooker and Arnott, Brit. Fl., Ed. vii., p. 198.

"*G. saccharatum*, All. Said to have been found . . . in the Carse of Gowrie, Forfarshire, by Mr. G. Don, and near Malton, Yorkshire, by Mr. R. Miller; but it does not appear to have been permanently naturalised in these localities." Syme, Eng. Bot., iv., p. 232.

Doubtless found by Don in the Carse of Gowrie, but as a casual plant only, and I think it probable that the Malton plant was true *tricorne*, for which Don mistook this species.

Tussilago alpina, *L.* (**Homogyne alpina,** *Cass.*).

"There is a specimen in Herb. Brodie from G. Don. . . . 'On rocks by the side of rivulets on the high mountains of Clova, as on a rock called Garrybarns,' . . . but we are not on that account prepared to admit the plant as indigenous." Hooker and Arnott, Brit. Fl., Ed. vii., p. 244.

"Mr. G. Don mentions *T. alpina*, an Austrian plant, found on the Clova mountains. May his plant not be the *Erigeron alpinus*, which he has not enumerated?" Gardiner, Fl. Forfar., pp. 110 and 111.

"Incognita. Included, like so many other dubious plants, among G. Don's discoveries in Forfarshire; but no other botanist appears to have found it in Britain. Mr. Gardiner suggests that Don intended *Erigeron alpinus*, but it is difficult to

conceive a mistake between plants so very dissimilar." Watson, Cyb. Brit., ii., p. 110. *See also* Comp. Cyb. Brit., p. 533.

"Mr. Borrer says of this, 'My specimen from G. Don is the true plant.' Such being the case I do not understand why the *Homogyne alpina* should be totally excluded from British Floras (*ex. gr.* Bab., Man.), while plants less likely to occur in Britain which rest on no safer authority are admitted even as genuine natives (*ex. gr. Potentilla tridentata*). I do not, however, believe this to be a British species." Watson, Cyb. Brit., iii., p. 459.

"Said by Mr. G. Don to have been found in Forfarshire; but it has been found by no one else." Syme, Eng. Bot., v., p. 217.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 477.

There is a specimen in Miss Palmer's collection labelled "Moist rocks on the Clova mountains, G. Don."

Mr. Gardiner's suggestion that Don mistook it for *Erigeron alpinus* will not do, since in correspondence he mentions finding the plant in Clova. I am more inclined to think that some young leafy specimens of *Tussilago Farfara*, which becomes very dwarfed in the alpine districts of Scotland—and I have seen such at nearly 3000 feet—and which is rare in such situations, may have been thought by Don to have been different from the lowland Coltsfoot, and planted in his garden may have afterwards been confused with *Homogyne alpina*, Cass. I suspect labelling in his garden was not a strong point, memory being probably in most cases relied on, and this eventually was sure to lead to error.

Erigeron uniflorus, *L.*

"Gathered on Ben Lawers, as well as on rocks by the river Almond, near Lindoch [Lynedoch], seven miles from Perth, by Mr. G. Don, who justly distinguished this species from *E. alpinum*." Smith, Eng. Bot., t. 2416 (1812). *See also* Smith, Trans. Linn. Soc., x., p. 346 (1811).

"Province 15. Perthshire; G. Don in Eng. Fl. Error. A misnomer of *E. alpinus* single-headed." Watson, Comp. Cyb. Brit., p. 533.

Don sent it to Smith as a form or new species, and it was Smith, not Don, who identified it with the *E. uniflorus*. In the "English Flora" Smith says, "Some have very unadvisedly confounded *E. alpinus*, in a luxuriant state, with our common *E. acris* . . . The near approach of these two, and of many foreign species to each other, though certainly distinct, may teach us caution with regard to E. uniflorus," but as it is seen it did not.

Centaurea intybacea, *L.*

"In the fields by the shore in several places in Forfarshire," and said by Don to have been "confounded with *C. Scabiosa*, which it much resembles." Don, in Headrick's Agric. Forfar.

"*C. Scabiosa*. A variety was gathered on dry banks, near the sea coast of Angusshire, by the late Mr. G. Don, which he thought distinct, and took for the *C. intybacea* of Lamarck . . . but has no specific mark." Smith, Eng. Fl., iii., p. 468.

"It seems likely that Don may have given the above name to the pale-flowered variety of *C. Scabiosa* . . . the resemblance between the two species not being such as to render their confusion very probable." Watson, Cyb. Brit., ii., p. 91. *See also* Comp. Cyb. Brit., p. 532.

"Said to occur in Forfarshire by Mr. G. Don—no doubt a pale-flowered variety of *C. Scabiosa* . . . as suggested by Mr. Watson." Syme, Eng. Bot., v., p. 216.

In this instance there is no doubt Don mistook a form of *C. Scabiosa* for south-western *C. intybacea*, which is not likely to occur in a wild state in Britain.

Crepis pulchra, *L.*

"Not at present known in our gardens, though said to have been cultivated at Chelsea in Rand's time. Mr. Don rightly determined it to be a *Crepis*, and the Linnæan specimen decides its species." Smith, Trans. Linn. Soc., x., p. 345 (1811).

"Amongst crumbling rocks on the hill of Turin, near Forfar." Smith, Eng. Bot., t. 2325.

The plate is drawn from a plant raised from seed sent by Don, who found it wild in 1796.

"Incognit. G. Don stated that he had found this plant . . . [on] the hills of Turin and Pitscandly in Forfarshire, but very rare. In one of these places—the hill of Turin—it was sought unsuccessfully by Mr. Gardiner in 1845, who says (Fl. Forfar., p. 99) that a turnip field now occupies the spot." Watson, Cyb. Brit., ii., p. 49. *See also* Watson, Comp. Cyb. Brit., p. 525, and Babington, Man., Ed. vii., p. 209. Hooker, Fl. Scot., p. 233.

"Mr. G. Don said that he found this plant among the *débris* of the rocks of the hills of Turin and Pitsandy [Pitscandly] in Forfarshire. Dr. Walker Arnott remarks in the "British Flora," 'The very few specimens from Don, which we have seen, are more luxuriant than Smith's acknowledged cultivated one, from which the figure in 'English Botany' was made." Syme, Eng. Bot., v., p. 217.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 478.

There is a specimen in Herb. Palmer.

Either a plant of casual occurrence, or possibly a form of *Crepis virens* gathered by Don and brought into his garden, was afterwards confused with the true *pulchra*. This is somewhat unlikely, because, when Don gathered it, *C. pulchra*, according to Smith, was not grown in British gardens, and as it was before Don went to the Edinburgh Botanic Garden he was not likely to be in a position to obtain seeds from abroad. The plant is not conspicuous, and so may be overlooked in North Britain, where it might occur as a native plant, since it is indigenous to Denmark, Norway and Sweden, etc.

Hieracium divaricatum, *G. Don.*

"Incognit. On rocks among the Clova mountains, according to G. Don." Watson, Cyb. Brit., ii., p. 61.

"Province 15. Clova mountains: G. Don. Ambiguity." Cyb., ii., p. 61. "*H. lingulatum*?" Backh. Mon., p. 30. Watson, Comp. Cyb. Brit., p. 526.

Miss Palmer's specimen from Don labelled *H. Lawsoni* is probably a weak form of *H. lingulatum*, which rather negatives the identity of Don's *divaricatum* with Backhouse's *lingulatum*.

At present the question remains unsolved as to what is the correct name of Don's *divaricatum*; that he discovered and named such a plant is beyond dispute.

Hieracium cerinthoides, *L.*

"Sent from the Highlands of Scotland by its discoverer, Mr. G. Don, who informs us this species is by no means uncommon there upon rocks." Smith, Eng. Bot., t. 2378. *See also* Smith in Trans. Linn. Soc., ix., p. 242 (1808).

"'Rocks near the head of Clova,' Mr. G. Don." Gardiner, Fl. Forfar., p. 102.

"It is, however, doubtful if Don knew the species well." Hooker and Arnott, Brit. Fl., Ed. vi., p. 214.

"Mr. Borrer's garden plant, mentioned on p. 59 of the second volume, was not of British origin; but it is believed by him to be the same species with the specimens from G. Don. Might not the latter be of garden and foreign origin only?" Watson, Cyb. Brit., iii., p. 453.

"Said by Smith to have been sent from the Highlands of Scotland by Mr. G. Don. The figure is from a cultivated specimen, and no doubt the plant which Don saw wild and believed to be the same was *H. anglicum* var. *β*." Syme, Eng. Bot., v., p. 218.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 478.

The specimen in Miss Palmer's collection shows that Don's plant is not the *cerinthoides* of Linnæus but the *H. cerinthiforme* of Backhouse, of which Don was the first discoverer in Britain. Smith was again in error in identifying it with the Linnean species.

Hieracium amplexicaule, *L.*

"Mr. Borrer possesses specimens from G. Don, gathered on the Clova mountains." Hooker, Fl. Scot., p. 232. *See also* Gardiner, Fl. Forfar., p. 102. Watson, Cyb. Brit., ii., p. 61.

"Found in the Clova mountains by the late Mr. G. Don." Eng. Bot., Suppl., t. 2690 (1831).

"Said to have been found on a rock called the Garrie Barns, Clova, Forfarshire, by G. Don, but no one else has been able to detect its presence there." Syme, Eng. Bot., v., p. 178. *See also* Watson, Comp. Cyb. Brit., p. 527.

There is no probability of the true *amplexicaule* being found native in Britain, although now naturalised in a few localities. Don probably saw *H. anglicum*, var. *amplexicaule*, Bab., and confused it with the Linnean species.

Salix Doniana, *Sm.*

"Sent from Scotland, as British, by the late Mr. G. Don to the late Mr. G. Anderson. *Mr. Borrer.*" Smith, Eng. Fl., iv., p. 213, and Eng. Bot., Suppl., t. 2599 (1829).

"Baldovan Woods, rare." Gardiner, Fl. Forfar., p. 165.

"Prov.? Scotland; . . . Ambiguity. Resembling *S. purpurea*." Watson, Comp. Cyb. Brit., p. 573.

"A native of dry places in mid and south Germany, described by Andersson as exactly intermediate between *repens* and *purpurea*, was stated by the late Mr. G. Don to be a native of Forfarshire, no doubt erroneously." Hooker, Student's Fl. (1870), p. 343.

"I do not see that this hybrid willow is 'no doubt erroneously recorded,' or why a hybrid willow (both parents of which grow in the vicinity) should not as likely be found in Baldovan Woods as elsewhere." Druce, in Scott. Nat., p. 263 (1884).

This willow has been re-found by Dr. Buchanan White on the bank of the Tummel below Pitlochry, see White, Fl. Perth., p. 281, and there is no doubt that Don was the first observer of this hybrid willow in Forfarshire.

Salix hastata, *L.*

"*S. malifolia*, Sm. Sands of Barrie, Mr. G. Don." Gardiner, Fl. Forfar., p. 169.

"It is most improbable that this plant, which is truly alpine on the Continent, growing in Switzerland only at great elevations, should be even naturalised upon the sands of Barrie, where Drummond met with it." Hooker and Arnott, Brit. Fl., Ed. vi., p. 399.

"Not native, even if . . . found in the locality." Syme, Eng. Bot., viii., p. 263.

Juncus tenuis, *Willd.* (**Juncus gracilis,** *Sm.*).

"Found by Mr. G. Don in 1795 or 1796, by the side of a rivulet in marshy ground among the mountains of Angusshire, but very rarely. It appears to us to be a nondescript, but we received from Mr. Dickson, some few years before the above date, a specimen not so far advanced towards maturity, of what seems to us the same species." Smith, Eng. Bot., t. 2174 (1810). *See* Bicheno in Trans. Linn. Soc., xii., p. 313 (1818).

"*J. tenuis*; D. Don, mss. ined. Moist mountains of Clova, D. Don. This plant precisely accords with specimens I have received from America . . . of the *J. tenuis*, Pursh." Hooker, Fl. Scot., p. 108.

"*J. Gesneri*, Sm. In dry elevated pastures in Scotland. Mr. Dickson. . . . Clova . . . Mr. G. Don." Smith, Eng. Fl., ii., p. 167.

"*J. tenuis*, Willd. 'By a rivulet in marshy ground, among the mountains of Clova, near their summits,' Mr. G. Don. Mr. D. Don." Gardiner, Fl. Forfar., p. 183.

"Such a record [as Don's] is worthless in science, until confirmed by some more accurate botanist of the present time." Watson, Cyb. Brit., iii., pp. 47 and 48.

"Prov. 15. Scotland; Dickson. Clova mountains; G. Don. Ambiguity. Neither authority is reliable; but the figure of *gracilis* in Eng. Bot., t. 2174, may pass well enough for one of true *tenuis*." Watson, Comp. Cyb. Brit., p. 586.

"We have specimens from Don's garden at Forfar, but we doubt much if the roots were found in Clova." Hooker and Arnott, Brit. Fl., Ed. vi., p. 451.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 480.

"A mistake." Babington, Man., Ed. vii., p. 364. *See also* Syme, Eng. Bot., x., p. 39.

There is a specimen in Herb. Palmer and in Don's own herbarium, the latter localised—"the only place we are acquainted with where this rush *(Juncus gracilis)* grows in Britain is on the Clova mountains, rare."

Juncus tenuis, which is probably an adventitious plant in Britain, and of North American origin, has been found during

the last fifteen years in several localities in England, Wales, Ireland, and Scotland; but we owe its discovery to Don and Dickson. Mr. Watson deliberately ignored Mr. David Don's confirmation of his father's record, which was also overlooked by the other critics of Don's record.

Eriophorum capitatum, *Host.*

"Discovered by Mr. Geo. Don, Aug. 12, 1810, by the side of a rivulet on Ben Lawers, near the limits of perpetual snow. The plants were rooted in a sandbank, and appeared to have been brought by alpine torrents from some still more inaccessible part of the mountain. His specimen agrees exactly with those sent by Prof. Schrader, and from Switzerland." Smith, Eng. Bot., t. 2387.

See Hooker, Fl. Scot., p. 20. Smith, Eng. Fl., i., p. 67.

"We fear Mr. Don had mixed, by mistake, some foreign specimens in his possession with the *E. vaginatum*, which is very common on Ben Lawers, and which alone we have found there: most specimens distributed by him belong to *E. vaginatum*." Hooker and Arnott, Brit. Fl., Ed. vii., p. 498.

"There is no 'perpetual' snow on Ben Lawers. . . . It must be remembered, however, that George Don was very inexact in describing localities, and that a bad description of a station will not necessarily imply intentional falsehood. There is said to be a specimen from Don in the herbarium of Sir W. J. Hooker which 'resembles *E. capitatum*, but the upper part of its stem is triangular.' (Babington, Man., Ed. iii., p. 352.) This is unsatisfactory. Is the specimen one of *capitatum*, or not? By the triangular stem it should rather be *vaginatum*. And yet, by the 'British Flora,' it would seem that Don's specimens were those of *E. capitatum*, suggested to be of foreign origin." Watson, Cyb. Brit., iii., p. 82.

"Error. Misnomer?" Watson, Comp. Cyb. Brit., p. 587.

"The figure in Eng. Bot., t. 2387, is certainly nothing more than *E. vaginatum*, and the only specimen of Don's supposed *E. capitatum* which I ever saw—viz., that which was in the herbarium of the Botanical Society of London—belonged without doubt to the same species." Syme, Eng. Bot., x., p. 174.

"*E. polystachion* (L.) *β minus*. An alpine form, has but one nearly sessile spike. *E. capitatum*, Don?" Babington, Man., Ed. vii., p. 385.

There is in Don's own herbarium a specimen labelled "*E. capitatum*, on Ben Lawers and Clova mountains. I discovered this in 1810." It is a small alpine form of *E. vaginatum*, L., not the *E. capitatum*, Host, which is synonymous with *E. Scheuchzeri*, Hoppe, as the stems are decidedly trigonous, and the

bracts are greyish green, not black. In this case again there is little doubt that Don sent Smith the specimens and Smith wrongly identified them with *E. Scheuchzeri*, as is proved by his own figure in "English Botany." The correct reading would be—An alpine form of *E. vaginatum* gathered by Don on Ben Lawers and Clova, mistaken for *E. capitatum*, Host, by Smith.

Carex ustulata, *Wahl.* (**C. atrofusca,** *Schkuhr*).

"Gathered in watery places in a micaceous soil on Ben Lawers by Mr. George Don, the only person who to our knowledge has met with this species in Britain." Smith, Eng. Bot., t. 2404.

"Mountains of Clova and Ben Lawers, G. Don." Hooker, Fl. Scot., p. 266.

"Stated to have been found 'on Ben Lawers, very rare' by George Don; so rare indeed that not one of the many botanists who have since been on that often examined hill has again found it." Watson, Cyb. Brit., iii., pp. 129 and 130.

"Prov. 15. Perth and Forfar; G. Don, sole authority. Error?" Watson, Comp. Cyb. Brit., p. 588.

"Specimens of *C. ustulata* were distributed by Mr. George Don and said by him to have been found on Ben Lawers. I possess one of these specimens labelled 1810, but since then the plant has not been found. The specimen alluded to has micaceous soil adhering to the roots, and it may therefore be assumed that it is not of garden origin. Don has never been accused of distributing foreign specimens of plants as British, though he often labelled specimens from his garden as being from stations where he erroneously believed he had seen the same species growing." Syme, Eng. Bot., x., p. 137.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 480.

"There is little doubt that Don actually gathered the plant somewhere in the Lawers district. Mr. Sturrock shrewdly suggests that Don was not only a botanist but a florist; and we gather from his correspondence that there was a good deal of jealousy between Don and other workers, so that he may have purposely extirpated the plant in the locality where he found it, and this may be also the case with other plants. If so, his botanical reputation has paid dearly for this short-sighted policy." Druce, in Scott. Nat., p. 266 (1884).

Since I wrote the foregoing, *Carex atrofusca* has been found on a slope above Lochan a Chait on Ben Lawers in 1892 by the Rev. D. Paul; and in 1885 on Ben Heasgarnich, where I have seen it growing in such a spot as Don describes. Here we have an instance of one of Don's "reputed discoveries" remaining again undetected for over 80 years on that often

examined hill, therefore even now I have confidence that a few more of his "reputed discoveries" will in the not distant future also be verified.

Carex hordeiformis, *Wahl.*

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 480.

"Prov. 15. Forfar. Thomas Drummond. Error. Watson, Cyb. Brit., iii., p. 143." Watson, Comp. Cyb. Brit., p. 591.

"Small valley about three miles west of Panmure; Mr. T. Drummond." Gardiner, Fl. Forfar., p. 217.

This appears to be "one of Don's reputed discoveries" which he never claims to have made. It should read, "One of Drummond's reputed discoveries."

Carex laxa, *Wahl.*

"Clova mountains, Forfar; Don. Error . . . Headrick's Agric. Survey of Forfar." Watson, Comp. Cyb. Brit., p. 591.

Phleum Michelii, *All.*

"Discovered by Mr. G. Don on rocky parts of the high mountains of Clova, Angusshire. This specimen agrees with authentic Austrian, Swiss, and Italian ones . . . except in being less luxuriant, owing probably to its more northern, or more barren, place of growth." Smith, Eng. Bot., t. 2265 (1811).

"Incognit. Don, in Headrick's 'Agricultural Survey of Forfarshire' [says], Lately I discovered three other grasses new to Britain, viz., the *Avena planoculmis* [*A. alpina*], . . . the *Aira lævigata* [*A. alpina*], and the *Phleum Michelii*. . . . These grasses grow on the very summit of the highest mountains. . . . Can it [*Phleum Michelii*] be the *Alopecurus alpestris* . . . [*A. alpinus*, var. *Watsoni*]? True, the figure in 'English Botany' does not represent an Alopecurus technically; but it bears that first-glance resemblance to my supposed *A. alpestris* which may suggest the possibility of Don having seen the one, and somehow substituted the other for it." Watson, Cyb. Brit., iii., pp. 157 and 158.

"Forfarshire. G. Don, sole authority. Error." Watson, Comp. Cyb. Brit., p. 592.

"No one has succeeded in verifying Don's discovery; the specimens given by him were cultivated ones." Hooker and Arnott, Brit. Fl., Ed. vii., p. 533.

"Said to have been found on the . . . highest mountains of Forfarshire by G. Don, but by no one else. Mr. H. C. Watson suggests that possibly the long-awned form of *Alopecurus*

alpinus to which I have given the name *Watsoni* may have been mistaken for it." Syme, Eng. Bot., xi., p. 199.

In Miss Palmer's collection there is a specimen from the Clova mountains labelled *Phleum Michelii* which is a form of *Alopecurus alpinus*, but as *Phleum Michelii* is labelled *A. alpinus* we may assume that Lady Aylesford accidentally transposed the labels. Don's own herbarium contains undoubted *Phleum Michelii* which he says he discovered in 1808 on the Clova mountains, but rare. The specimens are, I think, from his garden, for they are 24 inches high.

Hierochloe borealis, *R. and S.*

"Discovered in 1812 by the late Mr. George Don in a narrow valley called Glen Kella, among the Grampians of Forfarshire. In the same excursion the late Mr. Don collected specimens and plants of what he took to be a new species of *Melica* allied to *M. cærulea* which he called *M. alpina*. Mr. Lindley has also regarded it as a species, and named it *Molinia depauperata*." Eng. Bot., Suppl., t. 2641 (1830).

"Found only by Don, notwithstanding that Glen Kellar, or Cally, . . . has been minutely searched: the specimens we have seen from Don appeared to us to have been cultivated." Hooker and Arnott, Brit. Fl., Ed. vi., p. 531.

"Incognit. Glen Cally, Mr. G. Don. No other botanist, perhaps, has found this grass in the locality named, which is a long narrow valley descending from the high mountains near the head of Caness into Glen Isla. It does not grow about the head of the glen, which was carefully examined in July, 1843." Gardiner, Fl. Forfar., p. 199, and Watson, Cyb. Brit., iii., p. 153.

"Formerly in Forfarshire." Hooker, Student's Fl. (1870), p. 430.

"With respect to the 'minute search' referred to by Arnott (and the positive statement made by Mr. Gardiner that it does not grow about the head of the glen) it is only fair to say that one of the searchers afterwards stated that, although he had made a careful search, from what he had learned from Mr. Dick about the flowering of the plant, *i.e.* that it flowers in Caithness early in May, after which it withers and becomes impossible to find, and considering his search was made much later (July) in the year, he withdraws his former statement. Gardiner says the upper part of Glen Cally has been searched, but it is more likely to occur in the lower portion by the stream than among the rocks at the head." Druce, in Scott. Nat., p. 269, (1884).

I may add that in the very late season of 1902, which was fully a fortnight later than usual, I visited Dick's locality for

the Hierochloe at Thurso, and although I was taken by Mr. Lindsay, who knew the exact locality, we could not find a trace of the plant, which had been abundant there in May of the same year. The fact of the grass also being discovered in Kirkcudbrightshire makes it most probable that Don was correct, and it should inspire the local botanist to make a careful search on the alluvium bordering the stream at the lower portion of the glen in the middle of May, where there is great probability of his search being rewarded with success.

Triticum cristatum, *Schreb.*

"Discovered [by Mr. Don] on steep banks and rocks by the seaside, between Arbroath and Montrose, flowering very sparingly." Smith, Eng. Bot., t. 2267.

"The spikelets, in one of the Linnean specimens, are extremely hairy; in another, like Mr. Don's, smooth." Sm., Engl. Fl., i., p. 185. *See also* Gardiner, Fl. Forfar., p. 206.

"A plant almost peculiar to the east of Europe and Asia, . . . and which could not have been indigenous." Hooker and Arnott, Brit. Fl., Ed. vi., p. 556.

"Prov. 15. Forfar; G. Don. Lunan Bay, Arbroath. Ambiguity." Cyb. Brit., iii., p. 237. "Specimens from Don are in herbaria." Watson, Comp. Cyb. Brit., p. 597.

"Said by George Don to have been found by himself . . between Arbroath and Montrose, and in the 'Cybele Britannica' Mr. H. C. Watson states that in a letter from Sir W. C. Trevelyan, dated Aug. 19, 1839, he remarks that *T. cristatum* was then 'abundant in Lunan Bay, near Arbroath'; but in 1848 Mr. Gardner [Gardiner] asserted in his 'Flora of Forfarshire' that Don 'alone has found it.'" Syme, Eng. Bot., xi., p. 202.

"One of Don's reputed discoveries." Hooker, Student's Fl. (1870), p. 480.

In Don's own herbarium are specimens labelled "On dry banks between Arbroath and Montrose, but rare." One of them misnamed "var." but it appears to be a cultivated form of the other. I have no doubt that Don found it as he describes, but as an introduced plant. Its occurrence there is not so remarkable as that of the Kamschatchan Wormwood, *Artemisia Stelleriana*, which I found at Lunan Bay recently.

Because Gardiner says that "Don alone has found it," it proves neither that Don did not find it nor that no one else had. Although Trevelyan wrote to Watson (who adopts his locality in the Compendium), there is no evidence that he was a correspondent of Gardiner's, indeed we may assume that Gardiner knew neither the grass nor Trevelyan's statement about it.

Triticum caninum, *var.* **biflorum,** *Mitten.*

"The present is one of those plants gathered by the late Mr. G. Don which appears to have been overlooked by other botanists. His label in Mr. Borrer's herbarium runs thus:—'*Triticum alpinum, nova spec.* It differs from the *caninum* by its short arista and upright spikes, and from the *repens* by not running at the roots.' No date is mentioned. It is thus clearly evident that he distinguished it as a new species. The only British *Triticum* with which it can be confounded is *T. caninum*, from which it may be distinguished by its leaves smooth on both sides, its usually two-flowered spikelets, and its want of the long awn; it also appears to be a more slender plant, with narrower leaves. Rocks on Ben Lawers. Mr. Mitten, in Hooker's Lond. Journ. Bot., vii. (1848), p. 533." Watson, Comp. Cyb. Brit., iii., p. 237.

"Province 15. Ben Lawers, Perth. 'Don in Borrer Herb.' Ambiguity. Cyb. Brit., iii., p. 237." Watson, Comp. Cyb. Brit., p. 597.

"Is only *T. repens*." Hooker, Student's Fl. (1870), p. 453.

There is a specimen in Miss Palmer's collection labelled "Rocks, Ben Lawers (summit of)."

It was rediscovered on Ben Lawers by Dr. Buchanan White and Mr. F. J. Hanbury, and has been named *Agropyrum caninum*, Beauv., var. *Donianum*, by Dr. F. B. White, so there is no longer any "ambiguity" respecting it.

The foregoing list of Don's Reputed Discoveries may be divided into several groups:—

1. The first consists of eight plants, four of which I suggested in the Scottish Naturalist, 1884, p. 269, were really discovered by Don and which might probably be refound; they were:—

Sagina alpina.	**Carex ustulata.**
Juncus tenuis.	**Hierochloe borealis.**

In the nineteen years which have since elapsed all of these have been found; *Sagina alpina* by myself on the Cairngorms, *Juncus tenuis* scattered through Great Britain, *Carex ustulata* on Ben Lawers in Don's own station, and *Hierochloe borealis* in Kirkcudbrightshire.

Besides these there are four others which have been refound, viz.:—

Salix Doniana.	**Caltha radicans.**
Lychnis alpina.	**Alchemilla argentea.**

Salix Doniana in Perthshire, *Lychnis alpina* and *Caltha radicans*

had been previously gathered, and possibly *Alchemilla argentea*, so that eight of the doubted plants have been verified.

2. The second group consists of nine plants of casual occurrence, which there is no valid reason to doubt Don having gathered, some of which have been found in other parts of Britain, but have no claims for insertion in the list of native, denizen, or colonist plants of Britain:—

Rapistrum orientale, DC.
Neslia paniculata, Desv.
Hypericum barbatum, Jacq.
Chærophyllum aureum, L.
C. aromaticum, L.
Galium saccharatum, All.
G. spurium, L.
G. cinereum, Sm.
Triticum cristatum, Schreb.

Three of these have been gathered by myself.

3. Thirdly, there are a few species—three—which were certainly found by Don but which drainage or cultivation have extirpated:—

Crepis pulchra, L.
Eriophorum alpinum, L.
Deyeuxia neglecta, Kunth.
(**Calamagrotis stricta,** Nutt.).

The last of these I found in 1902 in Caithness.

4. Fourthly, another group consists of those plants—thirteen in number—which either by Don or Smith were recorded under incorrect names or confused with continental species. These are:—

Arabis ciliata, R. Br., a form of *A. hirsuta*, R. Br., misnamed by Mackay and Smith.

Stellaria scapigera, Willd., a monstrosity of *Stellaria graminea, L.*

Sanguisorba media, L., a form of *S. officinalis*, L., mis-named by Smith.

Galium aristatum, Sm., which is near *G. erectum*, Huds., and probably of casual occurrence, mistaken by Smith for the *aristatum* of Linnæus.

Centaurea intybacea, L., a form of *C. Scabiosa*, L.

Erigeron uniflorus, Sm. (not L.), which is *E. alpinus, L.*, misnamed by Smith.

Hieracium cerinthoides, L., which is *H. cerinthiforme*, Backh., misnamed by Smith.

H. amplexicaule, L., which is almost certainly *H. anglicum*, Fr., var. *amplexicaule*, Bab.

H. villosum, L., which is *H. eximium*, Backh., misnamed by Smith.

Eriophorum Scheuchzeri, Hoppe (*E. capitatum*, Sm.), which is a form of *E. vaginatum*, L., misnamed by Smith.

E. gracile, Sm., not of Koch, which is a form of *E. angustifolium*, Roth, misnamed by Smith.

Carex stricta, Good., is *C. aquatilis*, Wahl.

C. salina, Swartz, is *C. vaginata*, Tausch, and *C. tenella*, Schk., is a form of *C. remota*, L.

5. Fifthly, a group consisting of ten plants recorded by Don respecting which grave suspicion of error exists, and which will have to be re-found before they can be admitted to our list of British species.[1] Two or three of them may yet be rediscovered :—

Ranunculus alpestris, L.
Silene alpestris, Jacq.
Arenaria fastigiata, Sm.
(**Alsine Jacquini,** Koch).
Potentilla tridentata, Ait.
P. Nestleriana, Tratt.
(**P. intermedia,** Nestl., **P. opaca,** Sm.).
Saxifraga pedatifida, Sm.
S. muscoides, Wulf.
(**S. moschata,** Sm.).
Tussilago alpina, L.
(**Homogyne alpina,** Cass.).
Salix hastata, L.
(**S. malifolia,** Sm.).
Phleum Michelii, All.

I would direct especial attention to the desirability of exploring in April the localities referred to for *Ranunculus alpestris* and *Potentilla tridentata*, and early in May the more complete examination of Glen Kella for the *Hierochloe*. The higher summits, especially near Glen Dole and Loch Esk, should be searched for *Phleum Michelii*, and the lower hills for *Alsine Jacquini*. Search should also be made on the Arbroath cliffs and Lunan Bay for *Triticum cristatum*.

[1] See Mr. H. C. Watson's opinion quoted on p. 94.—*I. B. B.*

APPENDIX B.

GEORGE DON'S DISCOVERIES.

We have now a pleasanter duty in enumerating the more important of Don's undisputed discoveries, which amply bear out the remarks of Sir James E. Smith[1] in regard to his "scientific merits and eminent zeal."

Ranunculus nivalis, *L.*

High mountains near Mar Lodge. An alpine form of *R. acris*; specimen in Herb. Palmer and letter to Mr. Booth, 1812.

Caltha radicans, *Forst.*

Discovered at Carse in Forfarshire in 1790. New to science. *See* Eng. Bot., t. 2175 (1810).

Cochlearia alpina, *Wats.* (C. *grœnlandica*, Sm.).

Loch-na-gar, 1807. *See* Eng. Bot., t. 2403 (1812). New to science. Smith mistook it for Linnæus' *C. groenlandica*. *See* Trans. Linn. Soc., x. (1811), p. 344.

[1] "Notwithstanding the numerous additions to the British Flora, owing to the labour and acuteness of various observers, especially of Mr. Dickson, within the last 20 years, new discoveries of the most interesting nature are continually rewarding the zeal of the new votaries to botany. I need only advert to the Buxbaumia aphylla, the abundance of new Lichens, Fuci, and Confervæ, and the numerous Salices, which are amongst our more recent acquisitions, in proof of my assertion.

The richest harvest we have for a long time had was communicated to me in the course of last summer by Mr. George Don of Forfar, whose scientific merits and eminent zeal are sufficiently known to the Linnean Society. I have chosen a part of these treasures for the materials of my earliest tribute to the Society, at its first meeting for this season, after the long vacation. The plants shall be enumerated in systematic order, with such remarks as I may think useful or amusing to British botanists, accompanied by characters and descriptions of such species as, from their novelty and obscurity, may require that sort of illustration."—Smith, in Trans. Linn. Soc., x. (1811), p. 333.

Lepidium heterophyllum, *Benth., var.* **canescens,** *Gren. and Godr.* (*Thlaspi hirtum*, Sm. not L.), *L. Smithii*, Hook.

"*Thlaspi hirtum.* In 1800 Mr. J. Mackay sent me the true plant from Perthshire found by Mr. J. Miller; and the following year I received a variety with smooth fruit, gathered in Perthshire and Angusshire by Mr. G. Don." Smith in Eng. Bot., t. 1803 (1807). In Herb. Sowerby, Don has written on a label attached to specimen, "Thlaspi I call this *incana*, but as most of the genus are named from the places where they grow, I believe it would be better to call this *pratense*, as it is found only in meadows by the sides of rivers. It differs from the *campestre* in the form of the silicula and the largeness of the corolla, and in the stalks inclining to the ground in manner of *hirtum*—it is a biennial. I sent you a specimen of this before, supposing it the *hirtum*, but since I have got the true *hirtum* of Linn. Mr. Miller, gardener to the Earl of Kinnoul, was the first to take notice of this plant above 20 years ago; he found it in meadows in Strathearn, and I found it between Bricken and Montrose in Angusshire growing by the river Esk's side, but never found it in any part else by the rivers Esk and Earn. I believe this to be a nondescript."

The above note will show how clear Don was in his recognition of new forms. It was Sir James E. Smith who confused two different plants in English Botany under the above name.

Neslia paniculata, *Desv.* (*Vogelia sagittata*, Medik., *v. paniculata*, Hornem., *Myagrum paniculatum*, L.).

First observed by Don in 1795 at . . . Craichie near Forfar. *See* Don, Herb. Brit., No. 91 (1805). A casual, also found at Aberdeen in 1883, by Professor Trail; and at Oxford. *See* Druce, Fl. Berks., p. 69.

Lychnis alpina, *L.*

Little Culrannoch, Forfar. Discovered in 1795. *See* Eng. Bot., t. 2254 (1811), and Trans. Linn. Soc., x. (1811), p. 342. New to Britain.

Sagina Linnæi, *Presl.*

First published as *Spergula saginoides, L.*, found by Mackay in 1794 on Ben Lawers and gathered there by Robert Brown in the same year, but Don says he gathered it on Malghyrdy prior to that time. Eng. Bot., t. 2105 (1810).

Sagina maritima, *Don*, Herb. Brit., fasc. vii., No. 155 (1806).

Found on Ben Nevis [as the var. *alpina* in 1794] and in Skye, etc., and first described by Don as a new species to science.

Arenaria sulcata, *Schlecht.*

Conjointly found with Mackay on Ben Lawers, *see* Eng. Bot., Suppl., t. 2638 (1830), under the name *Arenaria rubella*, Hook. New to Britain. Don, in Herb. Brit. Mus., on specimen, says, "I first found it on Ben Lawers in 1793 with Mr. J. Mackay."

Oxytropis campestris, *DC.*

As *Astragalus campestris* at the head of Clova, 1812. Don, Herb. Brit., No. 213 (1812), and Eng. Bot., t. 2522 (1813). New to Britain.

Lotus tenuis, *Waldst. and Kit.*

First recorded for Scotland by Don. *See* Eng. Bot., t. 2615 (1829).

Rosa Doniana, *Woods.*

Differentiated by Don, who found it in Clova, from its allies, it has since been reduced to a variety of *R. involuta*, itself now considered not to be a true species but a hybrid of *Rosa spinosissima* and *R. mollissima*, Willd.=(*R. tomentosa*, Sm.). *See* Trans. Linn. Soc., xii. (1818), p. 185. Eng. Bot., Suppl., t. 2601 (1829).

Spiræa salicifolia, *L.*

First recorded from Scotland by Don. *See* Eng. Bot., t. 1468 (1805).

Alchemilla argentea, *G. Don* (*A. conjuncta*, Bab.).

Island of Skye. *See* Trevelyan "On the Vegetation and Temperature of the Faröe Islands," p. 10 (1837).

Saxifraga hirta, *Haw.*

S. sponhemica, Gmel., described as *S. platypetala* by Smith in Trans. Linn. Soc., x. (1811), p. 341, from specimens found on the Clova mountains by Don. Figured in Eng. Bot., t. 2276 (1811).

S. hypnoides, *L.*, *var.* **elongella** (*Sm.*).

"Gathered on a rock by a river called Lintrathen, a mile and a half north of Airly Castle, Angusshire." Described by Smith as a species in Trans. Linn. Soc., x. (1811), p. 340, and figured in Eng. Bot., t. 2277 (1811).

Epilobium alsinifolium, *Vill.*

An addition to the Scottish Flora made by Don and Mackay. Eng. Bot. t., 2000 (1809).

Galium uliginosum, *L.*

First recorded for Scotland by Don, Herb. Brit., No. 102 (1806), from the Pentland Hills.

G. erectum, *Huds., var.* **aristatum** (Smith, Eng. Fl., i., p. 203 (1824).)

A new variety to science found by Don in Forfar. *See* Eng. Bot., Suppl., t. 2784 (1834).

Valeriana pyrenaica, *L.*

First found by Don in Britain in 1782 and recorded by him in Herb. Brit., No. 77 (1805), from Blair Adam, etc., but it is not a native.

Kentranthus ruber, *Druce* (*Centranthus ruber, DC.*).

Recorded as *Valeriana rubra* for the first time as a Scottish plant by Don in Herb. Brit., No. 76 (1805), from Edinburgh, but it is not a native species.

Anthemis tinctoria, *L.*

Forfar, Eng. Bot., t. 1472 (1805), and contained in Don's Herb. Brit., No. 42 (1804). The first Scottish record of this casual species.

Lactuca alpina, *Benth.* (*Mulgedium alpinum,* Cass.).

Found by Don on Loch-na-gar in 1801, and sent by him to the Linnean Society in 1804. Described as *Sonchus cæruleus* in Eng. Bot., t. 2425 (1810).

Hieracium calenduliflorum, *Backh.*

A specimen from Loch-na-gar and the Clova mountains labelled *H. crispum* by G. Don is in Herb. Brit. Mus. Don says, "This is a distinct plant from any of the *Hieraciums* that I have seen described." New to science.

H. eximium, *Backh.*

Recorded under the name *H. villosum,* L., from the Clova mountains, *see* specimen in Herb. Palmer, but in Herb. Brit. Mus. a specimen is labelled by G. Don, "I collected this on Ben Nevis with *H. crispum.* I call it *H. laciniatum* and believe it to be distinct from *crispum* and *alpinum.*" New to science.

H. cerinthiforme, *Backh.*

Figured as *H. cerinthoides,* L., by Smith in Eng. Bot., t. 2378, but, as the specimen in Herb. Palmer shows, Don's plant was *H. cerinthiforme,* Backh., of which he was the first discoverer.

H. globosum, *Backh.*

"I call this *H. hyperboreum*. I found this upon Loch-na-gar . . . it never has more than one flower on the stem, not even when cultivated." G. Don, in Herb. Brit. Mus. The earliest specimen.

H. Dewari, *Boswell.*

This is the plant which Don collected by Loch Rannoch and which Smith in Eng. Bot., t. 2122 (1810), describes as *denticulatum*, and he says Don gathered it in 1794 and claims its first discovery. It has been confused with *H. strictum*, Fries, but the specimen labelled *denticulatum* by Don in Miss Palmer's collection is *H. Dewari*, and it is a question whether it should not bear Smith's name. The plant figured is from a cultivated specimen sent by Dickson from Harehead Wood, Selkirk.

H. lingulatum, *Backh.*

Under the name of *H. divaricatum*, Don reports this as new to Britain in Headrick's Agric. Forfar. (1813), p. 13, and there are specimens from "rocks among the Clova mountains" in Herb. Brit. Mus., although a probable specimen from G. Don of *lingulatum* from the Clova mountains is labelled, by Lady Aylesford, *H. Lawsoni*.

H. sparsifolium, *Lindeb.*

This is Don's *H. sylvaticum* "from fir woods near Forfar" in Herb. Palmer and the earliest Scottish specimen known.

H. prenanthoides, *Vill.*

Don first found it in Forfarshire, but *see* Smith, Fl. Brit., ii., p. 835 (1800).

H. crocatum, *Fries.*

Specimen collected by Don probably in 1812 from the river bed near Mar Lodge; and the earliest British specimen.

H. aurantiacum, *L.*

Woods in Banffshire. *See* Don's Herb. Brit., No. 41 (1804), figured in Eng. Bot., t. 1469 (1805). First as British, but not native

Campanula persicifolia, *L.*

From Cullen, found in 1802, but not native. Don, Herb. Brit., No. 180 (1806).

Myosotis alpestris, *Schmidt.*

Recorded as *M. alpinus* from Ben Lawers by Don in Herb. Brit., No. 205 (1805); figured under the name of *M. rupicola*, Smith, Eng. Bot., t. 2559 (1813). New to Britain.

M. repens, *D. Don.*

Found by G. Don on the Ochil Hills. *See* Hooker, Fl. Scot., p. 67 (1821). Figured in Eng. Bot., Suppl., t. 2703 (1831).

Bartsia alpina, *L.*

Said by Don in Herb. Brit., No. 63, to have been found by him on Mal-ghyrdy in 1789 for the first time in Scotland.

Lamium intermedium, *Fries.*

Cultivated fields, Angus, Don in Herb. Palmer. Is the earliest British specimen. Dr. Tyacke is given as the finder in Eng. Bot., Suppl., t. 2914 (1847). *See* Scott. Nat., p. 144 (1889).

Salix nigricans, *Sm., var.* **rupestris** (*Sm.*).

Forfarshire.

Salix lanata, *L.*

First found by Don in 1812. *See* letter to Mr. D. Booth, dated Nov. 1812. It was not published as a British plant until 1824 in Smith's Eng. Fl., iv., p. 205, where Drummond is mentioned as the finder, as also in Eng. Bot., Suppl., t. 2624 (1830), but David Don (under Eng. Bot., Suppl., t. 2666, *Carex Vahlii*), says his father first found it in Glen Callater.

S. Doniana, *Sm.*

In Eng. Fl., iv., p. 213 (1824), and figured in Eng. Bot., Suppl., t. 2599 (1829). A new hybrid discovered by Don in the Baldovan woods, Forfar, and subsequently found by Dr. Buchanan White in Perthshire.

Polygonatum verticillatum, *All.*

Don claims to have discovered this; *see* the Winch correspondence; although A. Bruce is given as the first finder by Smith in Eng. Bot., t. 128 (1793). Withering attributes its discovery to Don.

Sparganium affine, *Schnizl.*, *S. longifolium*, Fleming, *in lit.*

Don appears to have been the earliest observer of this species in Scotland; *see* Ann. Scott. Nat. Hist. (1899), pp. 186-187. He says he saw it in Skye, Ben Lawers, and the head of Mar Forest.

Potamogeton zosteræfolius, *Schum.*

Rescobie, *see* Eng. Bot., Suppl., t. 2685 (1831). Don, Herb. Brit., No. 204 (1806), the first Scottish record.

Luzula arcuata, *Sw.* (*Juncoides arcuatum,* O. Kuntze).

See Eng. Bot., 2688 (1831), where Don is said to have gathered it on the Grampians; although Sir W. J. Hooker is credited with its discovery in Smith, Eng. Fl., ii., p. 183. There is a specimen from Don in Herb. Palmer from the summit of Ben Mac Dowie [Mac Dhu], a high mountain near the head of the Dee. Don was on this mountain in 1812, and probably this is the earliest British specimen; he refers to it in his letter to Mr. Booth of 1812.

Juncus tenuis, *Willd.*

Found by Don in Forfar in 1795 or 1796, and recorded as *J. gracilis* by Smith in Eng. Bot., t. 2174 (1810); there are specimens in his herbarium, and in that of Miss Palmer, etc.

Juncus balticus, *Willd.*

In the "Flora Scotica" of 1821, p. 104, under *J. arcticus,* Hook., non Willd., Drummond is credited with the discovery, but there are specimens in Don's herbarium from the Sands of Barrie and near Montrose, labelled *J. filiformis,* which are the earliest known from Britain. Dickson also recorded *J. filiformis* from Ben Lawers, "but that much visited mountain" has never since been reported to yield the true *J. filiformis,* and although it has the credit of being the first Scottish record, I believe it to be so in name only. *See* Eng. Bot., Suppl., t. 2621 (1830).

Juncus lampocarpus, *Ehrh., var.* **nigritellus** *(D. Don).*

Found in the Clova mountains, G. Don. *See* Eng. Bot., Suppl., t. 2643 (1830).

Eriophorum alpinum, *L.*

Found in 1791 by Don and Robert Brown in the moss of Restenet, near Forfar, since eradicated by dredging the marsh for marl. Recorded in Eng. Bot., t. 311 (1796), and Trans. Linn. Soc., ii. (1794), p. 290. *See* Don, Herb. Brit., No. 26 (1804).

Carex aquatilis, *Wahl.*

Distributed in Herb. Brit., No. 192 (1806), from the side of the Esk under the name of *C. stricta,* Good., and the first as British, preceding Hooker and Greville's record in Eng. Bot., Suppl., t. 2758 (1832).

C. rariflora, *Sm.*

This new species to science was discovered by Don on the Clova mountains in 1807 and named by him *C. nivalis*, but Smith chose the name *rariflora* in Eng. Bot., t. 2516 (1813). Don, Herb. Brit., No. 215 (1812).

C. vaginata, *Tausch*, in Flora, iv. (1821), p. 587.

Found in 1802 by Don on the Cairngorms. *See C. salina*, Herb. Brit., No. 216 (1812), also in Eng. Bot., Suppl., t. 2731 (1832), as *C. phæostachya*. Don refers to it as *C. salina*, Swartz (from Ben Mac Dhu), in a letter to Mr. Booth dated 1812, but as a slightly different form from that which he first found on the Cairngorms. Don's discovery therefore was prior to Borrer, whom, under *C. Mielichoferi*, in Eng. Bot., t. 2293 (1811), Smith gives as the discoverer. Smith's name is older than that of Tausch, although subsequently in the "English Flora" he named practically an identical plant as *C. phæostachya*.

C. saxatilis, *L.* (*C. pulla*, Good.).

Found by Don on Ben Lomond in 1789 and by Mackay and Dickson subsequently, but in Eng. Bot., 2045 (1809), the credit is given to Mackay, although Don in Herb. Brit., No. 190, gives the history of its discovery, which has been claimed by Dickson.

C. divisa, *Huds.*

Found by Don for the first time in Scotland near Montrose, *see* Herb. Brit., No. 196 (1806), and for a long time was considered to be one of Don's "reputed discoveries" for Scotland until recently it has been re-found.

C. xanthocarpa, *Déség.*

Is contained in his herbarium under the name of *C. fulva* var. It is now considered to be a hybrid of *C. flava* and *C. Hornschuchiana*.

C. atrofusca, *Schkuhr.*

Ben Lawers, and first as British. Figured in Eng. Bot. as *C. ustulata*, Wahl., t. 2404 (1812), and re-found in 1892 by Rev. D. Paul.

C. flacca, *Schreb., var.* **stictocarpa,** *Druce.*

Described as a species by Smith in Eng. Fl., iv., p. 127 (1824), from Clova specimens sent by Don.

Alopecurus alpinus, *Sm.*

This interesting grass new to science was found by Don on Loch-na-gar. *See* Eng. Bot., t. 1126 (1803). Don, Herb. Brit., No. 4 (1804).

Deyeuxia neglecta, *Kunth (Calamagrostis stricta*, Nutt.).

Added to the British Flora by Don from the White Mire near Forfar in 1807, and figured under the name of *Arundo stricta* by Smith in Eng. Bot., t. 2160 (1810), and *A. neglecta*, Sm., in Trans. Linn. Soc., x. (1811), p. 337. It was shortly afterwards destroyed by drainage. In 1888 I had the good fortune to find it (under another modification) in a marsh by Loch Tay, Perthshire, namely as the *C. borealis*, Læstad., the *D. neglecta*, Kunth, var. *borealis*; but the marsh has since been filled up with sawdust, resulting from the sawing up of trees blown down by the great gale of 1893. It was a curious coincidence that, when in Caithness, just as I was completing the account of Don for my address to the Pharmaceutical Conference at Dundee, I found Don's *Arundo stricta*, *i.e.* type *Deyeuxia neglecta*, in a marsh near Thurso, thus again adding it to the Scottish flora, among which I trust it may for a long time be numbered.

Hierochloe borealis, *R. and S.*

Discovered by Don in Glen Kella. *See* Hooker, Fl. Scot., p. 28, and Eng. Bot., Suppl., t. 2641 (1830). Not found since in this locality, although elsewhere in Scotland.

Deschampsia alpina, *Beauv.*

Discovered by Don on Loch-na-gar, and described by Smith under the name of *Aira lævigata* in the Trans. Linn. Soc., x. (1811), p. 334, and figured in Eng. Bot., t. 2102 (1810). Specimens are in Don's herbarium.

Avena alpina, *Sm.*, in Trans. Linn. Soc., x. (1811), p. 335.

Found in Clova in 1807 by Don, and erroneously described as *Avena planiculmis* by Smith in Eng. Bot., t. 2141 (1810), but not of Schrader. Don did not think it was *planiculmis*, and it is now considered to be only a variety of *A. pratensis*. Specimens are in the Brit. Mus. Herb. and Don's herbarium.

Poa alpina, *L.*, *var.* **acutifolia,** *Druce.*

Found by Don on Loch-na-gar and thought by him to be *P. flexuosa*, Sm. *See* Don, Herb. Brit., No. 6 (1804).

Molinia varia, *Schrank*, *var.* **depauperata** (Lindley), *Melica alpina*, G. Don, ms.

Found in 1812 by Don; *see* under Eng. Bot., Suppl., t. 2641.

Agropyron repens, *Beauv.*, var. **Donianum,** *F. B. White*, *Triticum alpinum*, Don, ms., Ben Lawers.

Spec. in Herb. Palmer and Borrer, etc. *See* Mitten in Hooker's Lond. Journ. Bot., vii. (1848), p. 533.

Woodsia hyperborea, *R. Br.*

Sent by Don from Ben Lawers, but Dickson may have been the first to discover it in Scotland. *See Polypodium hyperboreum*, Eng. Bot., Suppl., t. 2023 (1809).

Equisetum variegatum, *Schleich.*

Discovered as a British plant on the Sands of Barrie, Forfar, by Don in 1807. *See* Eng. Bot., t. 1987 (1809).

Don was also among the earliest recorders of the following species as new to Scotland or as found in fresh localities :—

Brassica oleracea, *L.*

Inchkeith. Hooker, Fl. Scot., p. 203. First as Scottish if correctly named.

Raphanus maritimus, *Sm.*

Gairloch, 1793.

Draba muralis, *L.*

Edinburgh. Don, Herb. Brit., No. 188 (1806). Confirmatory of Lightfoot's record.

Dianthus Armeria, *L.*

Forfar. New to Scotland. Hooker, Fl. Scot., p. 134.

Saponaria officinalis, *L.*

Don, Herb. Brit., No. 183. New to Scotland.

Silene noctiflora, *L.*

From Forfar, only previously recorded from a field next to the Botanic Garden at Edinburgh. Don, Herb. Brit. No 12 (1804).

Silene nutans, *L.*

Near Montrose, probably new to Scotland. Don, Herb. Brit., No. 110 (1806).

Lychnis Viscaria, *L., var.* **alba.**

Airly Castle. Hooker, Fl. Scot., p. 142.

Cerastium trigynum, *Vill.*

Cerastium tetrandrum, *Curt.*

Forfarshire, etc. Don, Herb. Brit., No. 60 (1805).

Cerastium latifolium, *L.*, and **C. alpinum,** *L.*

From Ben Lomond (one of these was probably *arcticum*), and new to Scotland.

Sagina apetala, *Ard.*

New to Scotland. Don, Herb. Brit., No. 156 (1806).

Geranium phæum, *L.*

New as an alien to Scotland. Don, Herb. Brit., No. 92 (1805).

Ulex Gallii, *Planch.*, as **U. nanus,** *Forst.*

From the Pentlands. Hooker, Fl. Scot., p. 212.

Lathyrus montanus, *Bernh.*, *var.* **linifolius.**

Near Kinnaird. (*Orobus tenuifolius*) D. Don, in Mem. Wern. Soc., iii. (1820), p. 302. Hooker, Fl. Scot., p. 213.

Rosa Sabini, *Woods.*

Clova mountains. Hooker, Fl. Scot., p. 155.

Rosa involuta, *Sm.*

Clova mountains. Isle of Arran. Hooker, Fl. Scot., p. 154.

Rubus nessensis, *Hall* (*R. suberectus*, And.).

Forfarshire. Hooker, Fl. Scot., p. 159. Eng. Bot., Suppl., t. 2572 (1813).

Circæa intermedia, *Ehrh.*

Forfar.

Saxifraga rivularis, *L.*

Loch-na-gar. *See* Eng. Bot., t. 2275 (1811).

Ribes petræum, *Sm.*

Woods near Airly Castle. Hooker, Fl. Scot., p. 81.

Galium sylvestre, *Vill.*, *sub nom. G. pusillum.*

Pentlands, Clova. New to Scotland if rightly identified. Hooker, Fl. Scot., p. 52.

Galium Witheringii, *Sm.*

Forfar, new to Scotland. Hooker, Fl. Scot., p. 51.

Galium spurium, *L.*

Casual, Forfar. Don, Herb. Brit., No. 104.

Taraxacum palustre, *DC.*

See Hooker, Fl. Scot., p. 227.

Senecio sylvaticus, *L., var.* **lividus,** *Sm.*

Forfarshire. *See* Hooker, Fl. Scot., p. 243.

Crepis hieracioides, *Waldst. and Kit. (C. succisæfolia,* Tausch).

Don, Herb. Brit., No. 65 (1805). *See also* Dickson in Trans. Linn. Soc., ii. (1794), p. 288 (*sub Hieracium molle*), and Eng. Bot., t. 2210 (1810).

Hieracium umbellatum, *L.*

Perthshire.

Hieracium dubium.

Eng. Bot., t. 2332 (1811).

New to Scotland. *See* Hooker, Fl. Scot., p. 229.

Campanula rapunculoides, *L.*

Blair Athol. Don, Herb. Brit., No. 55 (1805).

Asperugo procumbens, *L.*

Forfarshire.

Symphytum tuberosum, *L.*

See Don, Herb. Brit., No. 133.

Pulmonaria officinalis, *L.*

Alien at Arniston. Don, Herb. Brit., No. 157.

Cynoglossum montanum, *Lam.*

New to Scotland. *See* Hooker, Fl. Scot., p. 69.

Teucrium Chamædrys, *L.*

As an alien; new to Scotland, from Forfarshire. Don, Herb. Brit., No. 167 (1806).

Lamium maculatum, *L.*

An alien, first in Scotland. *See* Hooker, Fl. Scot., p. 182.

Fagopyrum esculentum, *Moench.*

Cornfields. Don, Herb. Brit., No. 210 (1812), first in Scotland.

Chenopodium hybridum, *L.*

A new casual to Scotland. Hooker, Fl. Scot., p. 84.

Salix nigricans, *Sm., var.* **Andersoniana** *(Sm.).*

Clova. Hooker, Fl. Scot., p. 285.

Salix Lapponum, *L., vars.* **glauca** and **arenaria.**

From Clova. *See* Hooker, Fl. Scot., p. 283.

Tulipa sylvestris, *L.*

Brechin. *See* Hooker, Fl. Scot., p. 102.

Allium carinatum, *L.*

Banks of the Isla. Hooker, Fl. Scot., p. 101.

Juncus biglumis, *L.*

Ben Lawers.

Juncus supinus, *Moench.*

Ben Lawers, 1794, probably new to Scotland. It was miscalled *J. capitatus* by Sir W. J. Hooker in Fl. Scot., p. 106. *See* Don, Herb. Brit., No. 85 (1805), also var. *uliginosus* and var. *subverticillatus.* *See* Hooker, Fl. Scot., pp. 108 and 109.

Juncus castaneus, *Sm.*

Ben Lawers, 1794. *See* Don, Herb. Brit., No. 85.

Juncus Gerardi, *Lois.*

Sub nomine J. bulbosus var. in Herb. Don.

Juncus acutiflorus, *Ehrh.*

Forfar.

Juncus lampocarpus, *Ehrh.*

Forfar.

Luzula Forsteri, *DC. (Juncoides Forsteri,* O. Kuntze).

Forfar. Hooker, Fl. Scot., p. 110, if rightly identified, new to Scotland.

Luzula multiflora, *Lej.* (*Juncoides multiflorum,* Druce).

Forfar, Herb. Don.

Potamogeton heterophyllus, *Schreb.* (*P. gramineus*, L.).

Rescobie, Herb. Palmer. Hooker, Fl. Scot., p. 57.

Potamogeton alpinus, *Balb.* (*P. rufescens*, Schrad.).

Forfar.

Cladium jamaicense, *R. Br.* (*C. Mariscus*, R. Br.).

Restenet, near Forfar. *See* Hooker, Fl. Scot., p. 11.

Scirpus Tabernæmontani, *Gmel.*

Montrose. Herb. Don.

Scirpus rufus, *Schrad.* (*Blysmus rufus*, Link.).

Sands of Barrie and Isle of Skye. *See* Eng. Bot., t. 1010 (1802), and Don, Herb. Brit., No. 52 (1805), as well as var. *bifolius* (Wahl.).

Carex incurva, *Lightf.*

Sands of Barrie.

Carex filiformis, *L.*

Loch Ericht and Forfar, 1788. Don, Herb. Brit., No. 43 (1804).

Carex lævigata, *Sm.*

Angus. Hooker, Fl. Scot., p. 269.

Carex diandra, *Schrank* (*C. teretiuscula*, Good.).

Forfar, etc., Don, Herb. Brit., No. 189 (1806).

Deschampsia flexuosa, *Trin., var.* **montana** (*Huds.*).

Herb. Don.

(**Deschampsia discolor,** *R. and S.*

No locality. Herb. Don).

Deschampsia cæspitosa, *Beauv., var.* **glomerata.**

Hooker, Fl. Scot., p. 29=(*D. Doniana*, S. F. Gray, Nat. Arr. Brit. Pl. ii., p. 137).

Clova mountains.

Phleum arenarium, *L.*

Don, Herb. Brit., No. 79 (1805).

Poa cæsia, *Sm.*

Poa glauca, *Sm.*

Poa alpina, *L.*, var. **glomerata,** *Hull.*

River Esk, Angusshire. *See* Mem. Wern. Soc., iii. (1820), p. 296. Hooker, Fl. Scot., p. 34.

Poa pratensis, *L.*, *var.* **subcœrulea** (Sm.), (*P. humilis*, Ehrh.).

See Hooker, Fl. Scot. p. 35.

Poa trivialis, *L.*, *var.* **Koeleri,** (*DC.*). Herb. Don.

Glyceria distans, *Wahl.* (*Panicularia distans*, Kuntze).

Coast of Forfar and Fife. New to Scotland. Don, Herb. Brit., No. 176 (1806).

Festuca sylvatica, *Vill.*

Seen about 1790 by Don in Perthshire and Dumbartonshire. *See* Eng. Bot., t. 1006 (1802).

Avena strigosa, *Schreb.*

Don, Herb. Brit., No. 81 (1805).

Bromus giganteus, *L.*, *var.* **triflorus** (*Sm.*).

Perthshire. Herb. Don.

Bromus secalinus, *L.*

Angus and Fife. Hooker, Fl. Scot., p. 41.

Bromus hordeaceus, *L.* (*B. mollis*, L.), *var.* **glabratus** (*Doell*). Herb. Don.

Bromus tectorum, *L.*

As a casual, new to Scotland.

Bromus racemosus, *L.*

Angus. Hooker, Fl. Scot., p. 42.

Bromus commutatus, *Schrad.*

Sub nom. B. arvensis, L. Herb. Don.

Lepturus filiformis, *Trin.*

See Don, Herb. Brit., No. 178 (1806), but Lightfoot records it from Galloway. (Fl. Scotica, app., p. 1085, 1792).

Hordeum marinum, *Huds.* (*H. maritimum*, With.).

Angus coast. Hooker, Fl. Scot., p. 46.

Festuca loliacea, *Huds.* (*F. elatior* × *Lolium perenne*).

Forfarshire. Hooker, Fl. Scot., p. 40.

Festuca rotboellioides, *Kunth* (*Triticum loliaceum*, Sm.).

Angus. Hooker, Fl. Scot., p. 45.

Lolium arvense, *With.*

Forfar. Hooker, Fl. Scot., p. 45.

Lycopodium annotinum, *L.*

Clova.

Isoëtes lacustris, *L.*

See Eng. Bot., t. 1084.

It is scarcely necessary to say that some of the plants he records are not natives.

In addition, Don added several species of mosses to the Scottish flora, and all his records of these have been verified, two—*Grimmia Doniana* and *Anodus Donianus*—being named after him. Mr. H. N. Dixon has kindly examined all the specimens in Don's "Herbarium Britannicum," and finds that, with one exception, that of *Fontinalis squamosa*, which is a variety of *F. antipyretica*, all are correctly named, and he says that they are all undoubtedly British species, and some are sufficiently rare and others sufficiently inconspicuous to show the collector to have been an extremely keen observer.

A critical examination of a list of Don's discoveries enables us to bring his work into more correct focus, and to obtain a position favourable for arriving at a more accurate idea as to the authenticity of his records. But it is only fair to remember that at the time when Don lived the same precision of locality was not demanded of the botanist, nor was the same importance then attached to the fact that a specimen should come from the locality printed on the label, as is now the case. At that time the specimen itself was valued just as a stamp is now valued by the philatelist, and the other factors as to where it came from or by whom it was collected were to some extent ignored. Therefore we find that Don, even in his own herbarium, wrote out the localities of certain species from text-books before the plants were obtained; indeed, in some instances the place for the plant is still unoccupied. By this practice a loophole for error is at once presented. Again, the

geography of Scotland was imperfectly known, so that Don was often very vague in his localities, and this cannot be wondered at; and if, as sometimes occurred, he gave them from memory, another source of error is opened. Then, too, Don was a florist, and a florist in poor circumstances, and it is quite conceivable that he may, in some instances, have intentionally withheld the exact locality from business motives, so that another in the same trade should not take toll. And it must also be borne in mind that when he lived no British botanist had any but the most elementary knowledge as to the indigenity of plants. We notice that even in such a standard work as "English Botany" a large number of species are inserted which have no claims to be considered natives of Britain, although found growing in a wild state; and this is even true of Sir W. J. Hooker's "Flora Scotica." We therefore need not be surprised to find Don recording such alien plants as *Hypericum barbatum*, *Chærophyllum aureum*, and, because he found them wild, thinking them to be native. Then Don brought home many specimens, either in seed, root, or flower, and grew them in his garden; and anyone who is conversant with the difficulties under which all botanical gardens labour in the shape of misplaced labels, the encroachment of one species upon the domain of another,[1] in the case of annuals by seed-scattering, or of perennials by root-creeping, need not be surprised to find that Don, poor and overworked as he was, may, with three hundred British species in his Forfar garden, have fallen a victim to the unconscious transference of labels or specimens, and perhaps his memory at times, especially in later years, proved treacherous. To one or other of these causes may, I think, be attributed the records of such plants as *Potentilla tridentata* and *Tussilago alpina*. On the other hand, we must remember with gratitude the enormous energy which enabled him to add such a lengthy list of species to his country's flora.

This lengthy list of Don's discoveries contains such a number of new species, and such great rarities, and comprises so many critical forms, that it would be difficult to find one to rival it; and it places Don in the first rank of workers in the same field of research. We have seen again and again that Don's instincts were correct, but that Smith, then the acknowledged head of British botanists (and notwithstanding the great advantages he possessed in having an extensive foreign herbarium and the types

[1] See Dr. Neill's description of Don's garden, on p. 72.—*I. B. B.*

of Linnæus in his possession), had not the same natural appreciation of minute differences, nor that intuitive power of grasping the relationship of species which Don himself shows, and he lacked just that discriminating power which is only given to the full to those who work with untiring zeal among living specimens. This work of Don's was of the most unsparing kind, and was done, as so often it is obliged to be done, against adverse influences, and without the advantages of rank and fortune, but with the compensating assets which untiring zeal and patient industry, and the inborn touch of genius give to any of Nature's children who have been enriched with its heritage—that something with which no worldly gifts can endow us in a similar way. Don unmistakably was so gifted, and it kept him steadfast at his labours. He had besides that talent of discriminating slight differences which is lacking to many systematic botanists; but none can be truly great who is not its possessor. This discriminating power is evidenced again and again in his acute remarks upon his specimens.

As I have said, Don was too independent in opinion to curry favour with the wealthy, and too fond of Nature—by which I mean Science in the truest sense, hard mistress in some respects as she is to the poor—to make himself, by continuous application, a successful man of business. George Don is an instance—and there are many in the working-classes—of a life devoted to one idea; heroes assuredly, yet reaping no reward, except such reward as earnest and true work done for its own sake confers.

In the case of Don, some of us, and assuredly all who have trodden over the same lovely country which he has made known to us, and who have gathered in the same localities the rare and beautiful specimens he discovered or has left records of, will feel not only gratitude for what his labours have gained for us and made our common possession, but also respect for the independent and sturdy character of the man who lived such a life of toil and endurance.

APPENDIX C.

GEORGE DON'S HERBARIUM BRITANNICUM.

As Don's Herbarium Britannicum has in most instances been cut up, so as to allow the specimens to be inserted in herbaria, so that it is difficult to consult it as a whole, I have annexed from the nine fasciculi which Mr. Knox has lent me a verbatim copy of the labels, since they give very considerable information as to the localities of British plants, especially from Scottish localities. When the name now used differs from that which Don employs I have added it, and Mr. H. N. Dixon has kindly examined the Mosses. It will be seen that very few are misnamed, apart from changes of nomenclature. The sign ! means correctly named.

HERBARIUM BRITANNICUM,
G. DON,
Consisting of Fasciculi
of
Dried British Plants,
with their appropriate names and
particular habitats annexed
by
G. Don,
Associate of the Linnean Society.
Dedicated to Sir Joseph Banks.
Edinburgh, July 2, 1804.

FASCICULUS 1.

1. **Veronica montana,** *Eng. Bot., t. 766*!

In moist shady woods at Gordon Castle, near Fochabers; and in Lugton Wood, near Dalkeith.

2. **Scirpus acicularis,** *Eng. Bot., t. 749*!

Cyperus acicularis, Withering.

Ditches near Belmount Castle in Angusshire; and in the Hay Pool by the side of the river Earn, near Dupplin House, Perthshire. Found also by Mr. R. Miller (Dupplin House) in a drain called the Pow, near Methven, Perthshire.

[The first Perthshire record for *Eleocharis acicularis*, R.Br. —G. C. D.]

3. **Phleum alpinum,** *Eng. Bot., t. 519*!

On a mountain called Loch-na-Gare, in Aberdeenshire, and on Ben Lawers, Perthshire.

4. **Alopecurus alpinus,** *Eng. Bot., t. 1126*!

On moist rocks of Loch-na-Gare, near Invercauld, Aberdeenshire.

5. **Poa alpina,** *Eng. Bot., t. 1003*!

By the side of the river Esk, on a rock called Corbie Craig, parish of Tannadice; and by the side of the river Isla, near Airly Castle, growing among stones; and on the mountains of Clova; all in Angusshire.

[This is apparently a cultivated specimen 16 inches high. —G. C. D.]

6. **Poa flexuosa,** *Eng. Bot., t. 1123.*

On Ben Nevis, and on Loch-na-Gare. On Ben Nevis generally and on Loch-na-Gare always viviparous.

[This is not the *Poa flexuosa* of Wahlenberg, nor I think of Smith, but a slender form of *Poa alpina* with a narrow panicle which, in a paper read before the Linnean Society, March 1903, I have suggested should be called *P. alpina*, *L.* var. *acutifolia*. A second specimen presumably from Ben Nevis requires further study.—G. C. D.]

7. **Chironia pulchella,** *Eng. Bot., t. 458.*

Gentiana pulchella, Gmel.

By the seaside near Brodie House. First observed there by James Brodie, Esq.

[This is not *Erythræa pulchella*, Fries (*E. ramosissima*, Pers.), but *Erythræa littoralis*, Fries; forma *minor*, Hartm.– G. C. D.].

8. **Juncus biglumis,** *Eng. Bot., 898*!

By the side of rivulets near the summit of Ben Lawers.

9. **Arenaria serpyllifolia,** *Eng. Bot., t. 923*!

On dry sandy places and on walls.

[I think these should be referred to the var. *scabra*, Fenzl.—G. C. D.]

10. **Stellaria scapigera**, *Eng. Bot., t. 1269*!

By the sides of rivulets on the mountains of Badenoch, between Loch Ereachd and Loch Laggan, and by the side of a rivulet on a mountain to the eastwards of Loch Nevis, Inverness-shire.

[Apparently grown in garden soil, and a monstrous condition of *Stellaria graminea*.—G. C. D.]

11. **Stellaria glauca,** *Eng. Bot., t. 825.*

S. graminea, var. β, Huds.

By the sides of Lochend and Duddingston Lake, both near Edinburgh.

[*Stellaria palustris*, Retz.—G. C. D.]

12. **Silene noctiflora,** *Eng. Bot., t. 291*!

In sandy cornfields, by the seaside, between the villages of East and West Haines in Angusshire—the only known habitat in Scotland where it can be reckoned truly indigenous.

[Practically an addition to the Scottish flora.—G. C. D.]

13. **Euphorbia exigua,** Curtis, *Fl. Lond., fasc. 4, t. 36*!

In cornfields in Strathearn, but rare; and in the Carse of Gowrie, and on the side of a bank near the toll-bar at North Queensferry.

[The first Perthshire reference. The specimens have rather blunt apiculate leaves.—G. C. D.]

14. **Tormentilla reptans,** *Eng. Bot., t. 64.*

On ditch-banks by the roadside between Glasgow and Paisley; and near Hewell Hall, not far from Bromesgrove, in Worcestershire.

[*Potentilla procumbens*, Sibth. The first record for Worcestershire.—G. C. D.]

15. **Thalictrum alpinum,** *Eng. Bot., t. 262*!

On moist rocks and by the side of rivulets, on Ben Lawers, Ben Lomond, Benavorlich, Schichallin [Schiehallion], and the mountains of Clova, in Angusshire.

16. **Ranunculus auricomus,** *Eng. Bot., t. 624*!

In woods not infrequent.

[The upper leaves are notched on both margins.—G. C. D.]

17. **Brassica campestris,** *Fl. Dan., t. 550.*

Cornfields near Forfar; in the Isle of Skye; in cornfields near Edinburgh, by the side of the road leading from Queen Street to St. Bernard's Well; and near Stonehaven, Kincardineshire.

18. **Hieracium alpinum,** *Eng. Bot., t. 1110.*

On the summits of high mountains such as Loch-na-Gare, Ben Nevis, Ben Lawers, Malghyrdy, and mountains of Clova; and on a rock near the summit of a mountain called Craigundurn, about ten miles from Comry in Perthshire.

[The Rev. E. F. Linton thinks this is *H. eximium*, Backh. The first record for Perthshire.—G. C. D.]

19. **Carex remota,** *Eng. Bot., t. 832*!

In marshes near a fish-pool at Invermay in Perthshire, and among bushes to the east of Cable Haugh, by the side of the river Esk, in the parish of Tannadice, Angusshire.

[First record for Perthshire.—G. C. D.]

20. **Eriocaulon septangulare,** *Eng. Bot., t. 733*!

Eriocaulon decangulare, Lightf. and Hull.

Nasmythia articulata, Huds.

In a small lake called Loch na Caiplich, between Sligachan and Drynock, in the Isle of Skye.

21. **Splachnum sphæricum,** *Eng. Bot., t. 785*!

On the high mountains of Cairngorm in Inverness-shire, and in Loch-na-Gare, always on cow-dung.

22. **Polytrichum alpinum,** Dill. *Hist. Musc., t. 55, f. 4*!

On mountains and on mountainous heaths. These specimens from the summit of Benachie or Ben High, in Aberdeenshire.

23. **Trichostomum capillaceum,** *Eng. Bot., t. 1152.*

Bryum capillaceum, Dicks., Hull and With.

In marshes and on moist rocks, on Ben Lawers, Loch-na-Gare, and mountains of Clova; and on a rock called Craigmore, in Glen Tilt, near Blair Atholl. These specimens from Corbie Craig, in parish of Tannadice, Angusshire.

[*Swartzia montana*, Lindb.—G. C. D.]

24. **Grimmia conostoma,** *Eng. Bot., t. 1135.*

Bryum tetragonum, Dicks., Hull and With.

On the summit of the highest mountains, such as Ben Lawers, Ben Nevis, Loch-na-Gare, and Cairngorm.

[*Conostomum boreale*, Swartz.—G. C. D.]

25. **Lichen sphærocephalus,** *Eng. Bot., t. 414.*

Mucor lichenioides, Linn.

Clathrus cinereus, Huds.

Trichia lichenioides, With.

On a large oak tree at Balmanno Castle, in Strathearn, and on oaks in Den of Dupplin, Perthshire.

FASCICULUS II.—1804.

26. **Eriophorum alpinum.**

[Missing.– G. C. D.]

27. **Aira cristata,** *Eng. Bot., t. 648.*

Poa cristata, With., Relh., Sibth.

On walls and dry pastures not unfrequent. More plentiful in Scotland than in England.

[This is *Koeleria cristata*, Pers.—G. C. D.]

28. **Gentiana verna,** *Eng. Bot., t. 493; Bot. Mag., t. 491* !

In Teesdale Forest, Durham, kindly communicated to me by the Rev. Mr. Harriman. . . .

29. **Samolus Valerandi**, Curt., *Fl. Lond., fasc. 4, t. 20; Fl. Dan., t. 198; Eng. Bot., t. 703* !

Marshy ground near Dunfermline, and moist banks in a small wood between Limekilns and Charleston; also near Gourock, not far from Greenock, found by Mr. Austin of Glasgow. My specimens are from moist ditches in Goulan Links, East Lothian.

30. **Sium repens**, Jacq., *Fl. Austr., iii., t. 260.*

My specimens were collected from the moist parts of Goulan Links, near Aberlady, East Lothian. Not now to be found at Fisherrow, though repeatedly searched for.

[This is the slender plant with long peduncles which appears to be distinct from var. *ocreatum* (Bab.), and I should call it *Apium nodiflorum*, var. *repens*, Reichb., f.– G. C. D.]

31. **Trientalis europæa**, *Eng. Bot.*, *t. 15*; *Fl. Dan.*, *t. 84*!

In the north of Scotland, not unfrequent on mountains, but more plentifully in fir woods. My specimens are from woods near Forfar.

33. **Ranunculus parviflorus,** *Eng. Bot.*, *t. 120*!; Ray, *Syn.*, *Ed. iii.*, *p. 248*, *t. 12*, *f. 1*; Pluk., *Phytogr.*, *t. 55*, *f. 1*.

I observed this plant in 1784, on hedge-banks, about half a mile from Tutnell toll-bar, three miles east from Broomsgrove, Worcestershire; from whence my specimens were taken.

[The first Worcestershire record is in Stoke's edition of Withering of 1787, but Don appears to be the earliest observer. —G. C. D.]

34. **Raphanus maritimus!**

In the month of November, 1793, I observed this plant by the side of Gair Loch opposite . . . . It was also found in Galloway by the late Mr. John Mackay in 1797; the original discoverer probably was Mr. James Smith, nurseryman near Ayr.

[A mutilated label of a different kind accompanies this specimen: an abstract only is given.—G. C. D.]

35. **Leonurus cardiaca.**

[Missing.—G. C. D.]

36. **Astragalus glycyphyllos,** *Eng. Bot.*, *t. 203*!

Near North Queensferry; banks of Water of Leith, near Saughton; in Strathearn, Perthshire; about Arbroath, by the seaside plentifully.

[The earliest record for Perthshire.—G. C. D.]

37. **Astragalus hypoglottis,** *Eng. Bot.*, *t. 274*; *Fl. Dan.*, *t. 614*.

A. arenarius, Huds. and Relh.

King's Park, Blackford Hill, Figget Whins, and Caroline Park, near Edinburgh; Goulan Links, East Lothian; hills of Kinnoul and Moncrieff, Perthshire; dry sandy places by the side of the river Esk, and in the glen of Ogilvy, Angusshire. My specimens are from North Queensferry, where it grows with *A. uralensis*.

[This is *A. danicus*, Retz.=*A. hypoglottis*, Auct. Angl., non Linn.—G. C. D.]

38. **Astragalus uralensis,** *Eng. Bot., t. 464;* Lightf., *Fl. Scot., p. 401, t. 17.*

On rocks of Ben Lawers, but rare. On dry banks at North Queensferry, from whence my specimens were taken.

[*Oxytropis uralensis*, DC., and the earliest record for Perthshire, but it has not been confirmed for Ben Lawers.—G. C. D.]

39. **Vicia lathyroides,** *Eng. Bot., t. 30*!

On Salisbury Crags, and on the south side of Arthur's Seat, near the basaltic rocks; and Blackford Hill; all near Edinburgh; near Forfar and Kirriemuir, Angusshire; and near Forteviot, Perthshire.

[The earliest record for the latter county.—G. C. D.]

40. **Vicia lutea,** *Eng. Bot., t. 481*!

This rare Vicia I observed on banks close by the seashore, a little way east from the village of North Queensferry, in June 1804, in company with Messrs. P. Neill and G. White of Edinburgh.

41. **Hieracium aurantiacum,** *Fl. Dan., t. 1112*!

This beautiful Hieracium may be now regarded as an addition to the British flora, as I discovered it in a truly wild state in several woods in Banffshire, as at Craigston in the neighbourhood of Turriff.

[Wild, but not indigenous; there is no specimen in Mr. Knox's set.—G. C. D.]

42. **Anthemis tinctoria,** *Fl. Dan., t. 741*!

I observed this plant in the neighbourhood of Forfar in 1788, in abundance; but agricultural improvements have now rendered it more rare.

[A species of casual occurrence rarely found for long in one locality. The first Scottish record.—G. C. D.]

43. **Carex filiformis,** *Eng. Bot., t. 904*!; *Trans. Linn. Soc., ii., p. 172, t. 20, f. 5; Fl. Dan., t. 379,* exclusive of the detached spike. *C. tomentosa* of Lightfoot.

I observed this plant in the Moss of Restennet, near Forfar, in the year 1788; but it is more abundant in the White Myre [Mire], also near Forfar, where it covers several acres; likewise near Loch Ericht in Perthshire.

[The earliest record for Perthshire.—G. C. D.]

44. **Polypodium dryopteris,** Bolt., *Fil. 52, t. 28; Eng. Bot., t. 616.*

Found in shady places, and on mountains not unfrequent. My specimens are from the Den of Dupplin, Perthshire.

[*Phegopteris Dryopteris,* Fée.—G. C. D.]

45. **Phascum piliferum,** Schreb., *Phasc., p. 8, t. 1., ff. 6-10* !

Found on dry grassy banks. On the hills of Turrin and Finhaven near Forfar; Blackford Hill, and King's Park near Edinburgh, from whence these specimens were taken.

46. **Splachnum tenue,** Dicks., *Crypt., fasc. 2, p. 2, t. 4, f. 2.*

Sp. purpureum, Hull?

Sp. purpureum, With., Arrang., p. 794, t. 18, f. 9.

Also *Sp. tenue* of both these authors.

Found on the mountains of Cairngorm and Loch-na-Gare, always on cow-dung.

[*Tayloria tenuis,* Schimp.—G. C. D.]

47. **Grimmia nuda,** Dicks., *Crypt., fasc. 4, p. 7, t. 10, f. 15.*

Bryum nudum of Dickson.

I observed this plant in the month of March 1795, on clay banks by the side of the river Tay near Perth, producing its capsules from October to April or May.

[*Discelium nudum,* Brid.—G. C. D.]

48. **Orthotrichum aristatum,** Dicks.

O. diaphanum, Dicks., *Crypt., fasc. 4, p. 5, t. 10, f. 12.*

Found on trees in the Botanic Gardens, Edinburgh, and on apple trees in a garden at Hope Park near Edinburgh; at Dalguise, five miles from Dunkeld, Perthshire.

[*O. diaphanum,* Schrad.—G. C. D.]

49. **Polytrichum subrotundum,** *Hedw., Sp. Musc., p. 97, t. 21, ff. 7-9;* Dill., *Hist. Musc., p. 428; t. 55, f. 6 A-F.*

P. pumilum, Swartz.

Found on heaths and sandy places not unfrequent. These specimens from Ben Lawers, Perthshire.

[*P. nanum,* Neck.—G. C. D.]

50. **Lichen atrorufus,** *Eng. Bot., t. 1102.*

I have to acknowledge my obligation to the Rev. Mr. Harriman, for a number of excellent specimens of this lichen from Durham and Cumberland. I have observed it on heaths

in Angusshire not unfrequent; also on the mountain of Benachie or Ben High, in Aberdeenshire; and on the summit of the Cairngorm mountains, Inverness-shire, in great abundance. The crust in the figure in Eng. Bot. is of a much lighter colour than that of my Scotch specimens or of those I have received from England.

[*Lecidea atrorufa* (Dicks.).—G. C. D.]

FASCICULUS III.—1805.

51. **Schoenus nigricans,** *Eng. Bot., t. 1121* !

I observed it in marshes by the seaside near Brodie House, Morayshire; also near Loch-na-Caiplich, in some small lakes, where it grows plentifully with the *Eriocaulon septangulare*, and from which place my specimens were gathered. It has also been found wild on the west coast of Scotland by Mr. Smith, nurseryman near Ayr.

52. **Schoenus rufus,** Lightf., *Fl. Scot., t. 24, f. 2; Eng. Bot., t. 1010.*

On the coast of Fifeshire and near St. Andrews; Sands of Barry; and other places on the coast of Angusshire; Isle of Sky, east of Broadford by the seaside, whence my specimens were taken.

[*Scirpus rufus*, Schrad.—G. C. D.]

53. **Schoenus albus,** *Fl. Dan., t. 320; Eng. Bot., t. 985.*

For excellent specimens of this plant I am indebted to James Brodie, Esq., M.P., whose liberality on all occasions deserves my warmest acknowledgment of gratitude.

Found in marshes near Brodie House. I have observed it also in a marsh called "Moss of Balgown" in Perthshire; in the Isle of Sky, and near Loch Nevis, Inverness-shire, but in no place have I observed it in such plenty as in a marsh near Paisley.

[*Rynchospora alba*, Vahl. Methven Moss is probably the same as Don's station, which is the earliest reported for the county.—G. C. D.]

54. **Anagallis tenella,** Curtis, *Fl. Lond., fasc. 3, t. 15; Eng. Bot., t. 530* !

Specimens of this plant were kindly communicated to me by James Brodie, Esq., M.P., who collected them in marshes by the seaside near Brodie House. It also grows in Fifeshire, and has been found near Gourock, by Mr. Austin, nurseryman, Glasgow. It has also been found in great plenty at Deerness, in the Mainland of Orkney, by Mr. P. Neill of Edinburgh.

55. **Campanula rapunculoides,** *Eng. Bot., t. 1369*!

Found plentifully near Blair in Atholl, where my specimens were collected.

[Dr. Skrimshire is given as the discoverer under Eng. Bot., t. 1369.—G. C. D.]

56. **Erica vulgaris,** *B.*

Erica ciliaris, Huds.

I know of no figure that represents this variety. Specimens of this plant were obligingly sent me by Mr. James Hoy, who collected them near Gordon Castle. I have observed this heath in the parish of Marycoulter near Aberdeen; and also on a mountain called Werran, in Angusshire; but it is by no means common.

[*Calluna Erica,* DC., var. *incana*.—G. C. D.]

57. **Saxifraga oppositifolia,** *Fl. Dan., t. 34*! Curt., *Fl. Lond., fasc. 6, t. 27; Eng. Bot., t. 9.*

Found plentifully on Ben Lawers, and other mountains of Breadalbane; on Ben Lomond; Ben Nevis; Ben Vorlich; Ben-a-conich [Ben Chonzie]; Loch-na Gare; and the high mountains of Clova, Angus.

[The first record for Perthshire.—G. C. D.]

58. **Saxifraga tridactylites,** Curt., *Fl. Lond., fasc. 2, t. 28; Eng. Bot., t. 501*!

Found in King's Park, Edinburgh; on the tops of walls between Edinburgh and Colington; on rocks by the seaside betwixt Dundee and Broughty Castle; also in the crevices between the slates of some houses in Dundee; and on houses at Wormie Hills near Arbroath; likewise on the banks of the Forth, near Auchtertyre, to the west of Stirling.

[First record for Perthshire.—G. C. D.]

59. **Cerastium semidecandrum,** Curt., *Fl. Lond., fasc. 2, t. 33*!

On walls and shady places not unfrequent. Near Edinburgh and about Forfar, plentifully.

[The plant is scarcely so glandular as our Buckinghamshire specimens and it has a different facies.—G. C. D.]

60. **Cerastium tetrandrum,** Curt., *Fl. Lond., fasc. 6, t. 31*!

Sagina cerastoides, Eng. Bot., t. 166.

Found on wall-tops at Christian Bank near Edinburgh, on Inch Keith and Inch Colm; also near Musselburgh; at Stonehaven, in Kincardineshire, on roofs of cottages and tops of walls; on the sands at Barry and by the shore in some parts of Forfarshire, plentifully.

61. **Cerastium alpinum,** *Eng. Bot., t. 472; Fl. Dan., t. 6;* Lightf., *Fl. Scot., t. 10.*

C. latifolium, Lightf.

Found on Ben Lomond; Ben Lawers; and Loch-na-Gare. The distinguishing mark between this and *C. latifolium* [C. arcticum], which I have been enabled to discover in their native situation, where they are often intermixed, and approach each other in habit, is that in the *C. latifolium* the stamina are longer than the pistilla, and that in the *C. alpinum*, the pistilla are double the length of the stamina.

62. **Cerastium latifolium,** *Eng. Bot., t. 473;* Jacq., *Coll. i., p. 256, t. 20.*

Found on Ben Lomond; Ben Lawers; and other mountains of Breadalbane; Ben-a-conich [Ben Chonzie]; Ben Vorlich; mountains of Clova in Angusshire; Loch-na-Gare; and Cairngorm.

[The specimens are not in good condition and I should refer them to *C. alpinum* var. *lanatum* (Lam.), rather than to *C. arcticum*. They are not the *C. latifolium*, L. nor Jacq.—G. C. D.]

63. **Bartsia alpina,** *Eng. Bot., t. 361; Fl. Dan., t. 403;* Pluk., *Phytogr., t. 163, f. 5*!

The Rev. Mr. Harrison [Harriman] collected specimens of this plant near Middleton in Teesdale, and obligingly communicated them to me. I discovered this *Bartsia* on rocks on the east side of Malghyrdy, in the month of July 1789, the first time, I believe, it had been observed in Scotland. I communicated it to Mr. Dickson of Covent Garden in company with Mr. Mungo Park and Mr. Austin, nurseryman, of Glasgow, when Mr. Dickson was on his way to the Highlands in 1792. Also found by Mr. James Mackay in several places in the south of Ireland.

[The Irish plant is not *alpina*, but *B. viscosa*.—G. C. D.]

64. **Arabis hispida,** Pluk., *Phytogr., t. 101., f. 3; Fl. Dan., t. 386;* Dill., *Hort. Elth., t. 61, f. 71*; *Eng. Bot., t. 469.*

Cardamine petræa, Huds. and With.

b. Cardamine hastulata.

Cardamine petræa, Lightf., Fl. Scot., t. 15, f. 2.

N.B.—The right-hand or outer specimen is the var. *b.*

The first variety I observed on rocks and among stones by the head of Loch Awen; on the mountains of Cairngorm in Inverness-shire. It has also been found by Professor J. Beattie on rocks by the side of the river Dee, near Pananach Wells, Aberdeenshire. The variety *b.* I found among stones and

rocks by the sides of rivulets upon Ben-na-cailich in Strath, in the Isle of Sky.

[The *var. b.* is only a form with narrower and more deeply-cut leaves such as grows on exposed places; both are *Arabis petræa*, Lam.—G. C. D.]

65. **Hieracium molle,** Jacq., *Fl. Austr.*, *t. 119.*

I observed this plant among some bushes by the side of a rivulet, near a farm called the Meadows, three miles from Forfar; but at present I know of no other habitat.

[This is *Crepis hieracioides*, Waldst. and Kit. (=*C. succisæfolia*, Tausch), and the first record for the county.—G. C. D.]

66. **Hieracium umbellatum**, Curt., *Fl. Lond.*, *fasc. 6, t. 58; Fl. Dan., t. 680*!

This plant although not rare in some parts of England is considered rather of rare occurrence in Scotland. I observed it by the side of the river Tay on the road between Dunkeld and Balnagird; but rare. I observed it likewise at Faggot [Figget] Whins, near Edinburgh, from whence my specimens were taken. It has also been found, though sparingly, at Dupplin, Perthshire, by Mr. R. Miller.

[First record for Perthshire.—G. C. D.]

67. **Satyrium repens,** *Eng. Bot., t. 289;* Lightf., *Fl. Scot., 520, t. 22;* Jacq., *Fl. Austr., t. 369*; *Fl. Dan., t. 812.*

Woods near Brodie House, James Brodie, Esq. It has also been observed in woods near Gordon Castle, by Mr. J. Hoy. I have likewise found it in woods near Granton [Grantown], and in a fir-wood near Forfar.

[*Goodyera repens*, R. Br.—*Peramium repens*, Salisb.—G. C. D.]

68. **Carex pauciflora,** Lightf., *Fl. Scot., p. 543, t. 6, f. 2*!

Found on Ben Lomond; on mountains between Loch Ern and Loch Tay; also on the mountains of Breadalbane; Isle of Sky; and mountains between Loch Eil and Loch Urn; on Loch-na-Gare; and in Glen Mick; in Glen Esk in Angusshire, not two hundred yards from corn-land. And on mountains on the north of Blair in Athol.

[First record for Perthshire.—G. C. D.]

69. **Aspidium aculeatum,** Bolt., *Fil., p. 48, t. 26.*

Polypodium aculeatum, Linn., Huds., With., Hull., Relh., Sibth., Bolt., etc.

Found on rocks and in woods in shady situations. My specimens are from the Den of Dupplin, Perthshire.

[*Polystichum aculeatum*, first record for Perthshire.—G. C. D.]

70. **Phascum cuspidatum,** Curt., *Fl. Lond., fasc. 4, t. 60; Fl. Dan., t. 249, f. 3;* Dill., *Hist. Musc., t. 32, f. 11* !

Phascum acaulon, Linn., Huds., With., Hull.

Found amongst stubble and fields sown with grass, and in gardens. About Edinburgh and near Forfar plentifully.

71. **Gymnostomum ovatum,** Hedw., *St. Crypt., v. i., t. 6.*

Found on the tops of walls in the neighbourhood of Edinburgh, not unfrequent.

[*Tortula pusilla,* Mitt.—G. C. D.]

72. **Grimmia Doniana,** *Eng. Bot., t. 1259* !

I discovered this moss in 1795, on large stones near a waterfall on one of the mountains of Clova in Angusshire, eighteen miles north of Forfar, as mentioned in "Flora Britannica." I have since found it on stones on the Pentland Hills, near Edinburgh; also on stones on Ben Lawers.

73. **Dicranum fuscescens,** Turn., *Musc. Hib., t. 5, f. 1* !

I observed this moss on the summit of Ben a High in Aberdeenshire; mountains of Clova in Angusshire; and on rocks on the Pentland Hills near Edinburgh.

74. **Dicranum rufescens,** *Eng. Bot., t. 1216;* Dicks., *Crypt., fasc. 3, t 8, f. 1.*

In my opinion, the whole figures I have seen of this plant are drawn beyond the natural size.

Found in wet stubble fields near Finhaven, and on ditch-banks near Forfar; plentifully on banks by the foot of Ben Lawers, also in fields to the west of Logie Almond, Perthshire; and on the banks of a rivulet, above the upper water reservoir, near Dreghorn, Pentland Hills.

[*Dicranella rufescens,* Schp.—G. C. D.]

75. **Lichen Fahlunensis,** *Eng. Bot., t. 653; Fl. Dan., t. 958;* Dill., *Hist. Musc., p. 24, t. 81;* Hoffm., *Enum. Lich., p. 17, t. 2.*

[*Platysma Fahlunense* (L.).—G. C. D.]

Found on stones on the lofty mountains in the Highlands of Scotland, as Ben Lawers, Schehallion, and other mountains in Breadalbane; Ben Nevis, Loch-na-Gare and Cairngorm, and the mountains of Clova in Angusshire.

FASCICULUS IV.—1805.

76. **Valeriana rubra,** Riv., *Monop. Irr., t. 3., f. 2.* [Ord. pl. irreg. monopet.]

Growing on a wall at Inverleith, near Edinburgh, from whence my specimens were taken.

[*Kentranthus ruber*, Druce; *Centranthus ruber*, DC., the first Scottish record, but only as an alien species.—G. C. D.]

77. **Valeriana pyrenaica,** Buxb., *cent. ii., t. 11* !

I first observed this plant in 1782, by ditches and by the sides of walls, near Blair Adam, Kinross-shire. I have also seen it in a wild state near Glasgow. I have since noticed it in one or two other places in Kinross-shire; and some time ago (in company with Messrs. Maughan and J. Neill) I found it plentifully, in a moist wood on the banks of the river Leith, about a mile below Collington, and three miles from Edinburgh; and in September 1805 I observed it on the side of a small rivulet, in a wood at Abercorn, Linlithgowshire (in company with Messrs. P. Neill and Hosey) . . . There can be no doubt whatever of this being a plant truly indigenous to Scotland.

[Wild but not indigenous in Great Britain; this is the first record.—G. C. D.]

78. **Poa rigida**, Curt., *Fl. Lond., fasc. 2, f. 4; Eng. Bot., t. 1371.*

In the King's Park, Edinburgh, especially below Salisbury Craigs, where my specimens were gathered. I have since observed it on walls near Burntisland, Fifeshire; but this Poa may be considered as of rare occurrence in Scotland.

[*Festuca rigida*, Kunth.—G. C. D.]

79. **Phalaris arenaria,** *Eng. Bot., t. 222;* Pluk., *Phytogr., t. 33, f. 8.*

Growing plentifully on the seashore, near Wormyhills, two miles west of Aberdeen; on the Sands of Barry, seven miles east from Dundee; and on the shore, about a mile north from Montrose, all in Angusshire. Also near Aberdeen and Banff; and at Prestonpans in East Lothian.

[*Phleum arenarium* L.—G. C. D.]

80. **Avena fatua,** Leers., *Fl. Herborn, p. 42, t. 9, f. 4;* Mart., *Fl. Rust., t. 81* !

Very common in cornfields in Scotland. My specimens collected in fields near Pentland Hills.

[It is the variety *pilosissima*, S. F. Gray.—G. C. D.]

81. **Avena strigosa,** *Eng. Bot., t. 1266;* Host., *Gram., 2, p. 41, t. 156*!

This is still more common in cornfields in Scotland than *A. fatua.* It is no doubt a native, though in the extreme northern parts of Scotland, and in the islands of Orkneys and Shetlands, it is the only kind of oat cultivated for grain.

82. **Cornus suecica**, *Fl. Dan.*, *t. 5*; Dill., *Hort. Elth.*, *p. 108*, *t. 91*; Linn., *Fl. Lapp.*, *t. 5*, *f. 3*; *Eng. Bot.*, *t. 310*!

Plentiful on the mountains of Breadalbane in Perthshire; mountains of Loch-na-Gare, Aberdeenshire; Cairngorm, Inverness-shire, and mountains of Clova, Angusshire.

83. **Phyteuma orbiculare**, *Eng. Bot.*, *t. 142*; Jacq., *Fl. Austr.*, *t. 437*!

Specimens supplied by James Sowerby; unlocalised.

84. **Juncus uliginosus**, *Fl. Dan.*, *t. 817*; Scheuchz., *Agr.*, *t. 7*, *f. 10*.

I have been favoured with some specimens of this plant collected by James Brodie, Esq., near Brodie House. I have observed it in marshes, not unfrequently, near Forfar; in the King's Park, Edinburgh; and other places in Scotland. I have been induced to give this plant along with the next species (the *J. supinus*), as Willdenow considers them as varieties of the same plant. I consider my plant as belonging to var. *b.* of "Flora Britannica."

[*Juncus supinus*, Mönch, = *J. bulbosus*, L. -G. C. D.]

85. **Juncus supinus**, *Fl. Dan.*, *t. 1099*.

I observed this plant, in October 1804, by the side of a rivulet, near the summit of Ben Lawers, in a situation where the snow remains during the greater part of the year, and not far from the spot where I first discovered the *Juncus castaneus* in May 1794, at which time the first-mentioned place was deeply covered with snow. I have cultivated the plant, carefully compared my specimens in their different appearances with the figure in "Flora Danica," which I consider as a just representation of this variable plant. The leaves which accompany the flowers, where they become terminal, give the plant the appearance of being viviparous. The plants which I have cultivated, flowered in July; but in their native place, they do not probably shew their flowers earlier than August or September. Willdenow has given this as a variety of the *J. subverticillatus*, under which he also includes the *J. uliginosus*.

[Very small specimens of aggregate *J. supinus*, Mönch, = *J. bulbosus*, L., which Sir W. J. Hooker (Fl. Scot., p. 106) mistook for *J. capitatus*. First record for Perthshire.—G. C. D.]

86. **Saxifraga stellaris**, *Fl. Dan.*, *t. 23*; *Eng. Bot.*, *t. 167*; Jacq., *Coll.*, *i.*, *p. 202*, *t. 13*; Scop., *Fl. Carn.*, *Ed. ii*, *p. 292*, *t. 13*!

Common on the mountains of Scotland, by the side of rivulets.

87. **Saxifraga aizoides**, *Eng. Bot.*, *t. 39*; *Fl. Dan.*, *t. 72*; Scop., *Fl. Carn.*, *Ed. ii.*, *p. 293*, *t. 14*!

Common in marshy places and by the sides of rivulets in the Highlands of Scotland; and also in turfy bogs in the lowlands, as in a marsh called the White Myre [Mire], near Forfar.

88. **Thalictrum minus,** *ng. Bot., t. 11.*

By the seaside near Arbroath, Angusshire; by the side of the Tay, about a mile above Perth; near Blair in Atholl, plentifully near Loch Rannoch, Perthshire; near Montrose; North Queensferry; and at Caroline Park near Edinburgh, from whence my specimens were collected. It has also been observed by my friend Mr. P. Neill, in the parish of Deerness in the Mainland of Orkney.

[*Thalictrum collinum*, Wallroth. Don includes *T. dunense* in the above records.—G. C. D.]

89. **Galeobdolon luteum,** Curt., *Fl. Lond., fasc. 4, t. 40;* Pet., *Herb. Brit., t. 33, f. 6.*

Galeopsis Galeobdolon, Linn. and Lightf.

By the sides of hedges and in woods, not unfrequent in several places in Worcestershire and Warwickshire. My specimens were collected near Haddington, East Lothian; probably the habitat referred to by Lightfoot.

[*Lamium Galeobdolon*, Crantz.—G. C. D.]

90. **Scrophularia vernalis,** *Eng. Bot., t. 567; Fl. Dan., t. 411!*

Near Scoon and also near Cluny, Perthshire; and near Lower, about two and a half miles south from Forfar; but I have never observed it any great distance from gardens.

[A new record for Perthshire.—G. C. D.]

91. **Myagrum paniculatum,** *Fl. Dan., t. 204;* Gaertn., *De Fruct. et Sem. Pl., fasc. 9, t. 141, f. 9.*

I first observed this plant in 1795, in a gravelly soil, near a rivulet at a village called Craichie, three miles and a half south from Forfar, Angusshire. The ground here had never been cultivated; and I am therefore of opinion that the *M. paniculatum* has a better title to a place in the British flora than the *sativum*, which has been admitted to it. I may further remark that I never saw *M. paniculatum* growing among flax or grain, where the other has generally been found. Although I am convinced that my plant is the true *M. paniculatum* of Linnæus, I confess that it does not agree well with the figure in "Flora Danica."

[This is *Vogelia sagittata*, Medik.= *Neslia paniculata*, Desv. — G. C. D.]

92. **Geranium phæum,** *Eng. Bot., t. 322; Fl. Dan., t. 987*!

In a wood near Dupplin, Perthshire; also near Auchterhouse, about twelve miles from Forfar, where it appears to be truly indigenous.

[First Scottish record, but it is not native.—G. C. D.]

93. **Geranium columbinum,** *Eng. Bot., t. 259*!

I observed this plant in cornfields near the seat of Lord Plymouth in Worcestershire; also at the hills of Kinnoul and Moncrieff near Perth, from the last of which places my specimens were kindly communicated by Mr. John Mitchell at Moncrieff House.

[First record for Perthshire and Worcestershire.—G. C. D.]

94. **Trifolium arvense**, *Fl. Dan., t. 724;* Curt., *Fl. Lond., fasc. 6, t. 50*!

In sandy cornfields, and in dry pastures, not unfrequent. My specimens from Figget Whins near Edinburgh.

95. **Artemisia maritima,** Woodv., *Med. Bot., t. 122*!

On the seacoast near Dunninauld [Denninald], Angusshire. Plentiful on Goulan Links, East Lothian, from whence my specimens were obtained.

[First Forfar record.—G. C. D.]

96. **Carex capillaris,** *Fl. Dan., t. 168;* Scop., *Fl. Carn., Ed. ii., p. 220, t. 59*!

On rocks on the east side of Malghyrdy; on Ben Lawers; and in Glen Tilt, near Blair in Atholl, all in Perthshire.

97. **Fontinalis antipyretica,** *Eng. Bot., t. 359*!

In rivers and rivulets not unfrequent in Scotland, but seldom in fructification. I collected my spec. (May 1805) in a rivulet in Morefoot Hills, about fifteen miles south from Edinburgh, being the only place I ever found it in fructification.

98. **Hypnum cordifolium,** Hedw., *Sp. Musc., p. 254; id., St. Crypt., iv., p. 97, t. 37; Eng. Bot., t. 1447*!

I first observed this moss in marshy places in the neighbourhood of Forfar in 1788, but seldom producing capsules. I have since noticed it in marshes near Edinburgh, my specimens being collected from the side of Duddingston Loch near that city.

99. **Bryum dealbatum,** Dicks., *Crypt., fasc. 2, t. 5, f. 3;* Hedw., *Sp. Musc., p. 174, t. 41, ff. 6-9;* Swartz, *Musc. Suec., pp. 44 and 94, t. 5, f. 10.*

In bogs near Forfar, but rare; on a moist bank by the sea-side, near the ruins of Dunottar Castle by Stonehaven, Kincardineshire. My specimens from a marsh in the King's Park, Edinburgh.

[Now called *Amblyodon dealbatum*, Beauv.—G. C. D.]

100. **Lichen orestœus.**

On fir trees near Forfar; and on fir trees at Caroline Park near Edinburgh, from whence my specimens were collected. I sent this lichen to Dr. Smith, who is of opinion that it is *L. orestæus* of Acharius growing on wood, it being usually found in Sweden, growing on rocks. I have also observed it on rocks in Ravelston Wood, near Edinburgh; and Dr. Smith is therefore probably correct.

FASCICULUS V.—1806.

101. **Festuca bromoides,** Pluk., *Phytogr., t. 33, f. 10;* Relh., *Rudb., t. 17, f. 3;* Scheuchz., *Agrost., t. 6, f. 10; Eng. Bot., t. 1411.*

On walls and dry places not unfrequent. These specimens were collected from wall tops near Edinburgh.

[This is *Festuca sciuroides*, Roth.—G. C. D.]

102. **Galium uliginosum!**

I am not acquainted with any figure of this plant. It is not very uncommon in marshes in Scotland. My specimens were gathered in a marsh in Pentland Hills, near Edinburgh.

[The first Scottish record —G. C. D.]

103. **Galium tricorne,** Mart., *Fl. Rust., t. 122;* Vaill., *Bot. Paris., t. 4, f. 3, a a.*

Valantia aparine, Mart.

Galium spurium, Huds., With., Relh., and Sibth.

In cornfields, but rare. I have observed it sparingly in the Carse of Gowrie. It has likewise been observed in cornfields, near Malton in Yorkshire, by my friend Mr. R. Miller, gardener to the Earl of Kinnoul.

[This is *G. saccharatum*, All., a new record for Scotland.—G. C. D.]

104. **Galium spurium,**—fide clariss. et amiciss. D. Smithii, qui hoc galium specimine Linneano contulit.

I first observed this plant in 1784 in cornfields, near the village of Red Ditch [Redditch] in Worcestershire, but very rare: I have in my possession a specimen from that place. I

next observed it in 1801, in cornfields near the village called Loch-head about two miles from Forfar, but not common. Dr. Smith, who had the goodness to compare specimens of this Galium with the Linnean Herbarium, found that my plants agreed in every respect with the Linnean specimen. The circumstance of the seeds being large, smooth, and shining, distinguishes it from all other British Galiums.

[New to Britain, but as a casual plant. Smith figured it in Eng. Bot., t. 1871 (1808).—G. C. D.]

105. **Galium verum**, Curt., *Fl. Lond.*, *fasc. 6, t. 13;* Mart., *Fl. Rust., t. 54*!

On dry banks and pastures, common. This plant I have given as one of the most beautiful of the British Galiums.

106. **Galium mollugo**, *Fl. Dan., t. 455*!

I observed it about Dreghorn, and in several other places near Edinburgh; in the Carse of Gowrie; Hill of Burnside near Forfar; and also near the village of Broadsworth in Yorkshire.

[This is *G. Mollugo*, L., and the first certain Scottish record as *G. erectum* was not clearly distinguished by Sibbald or Lightfoot.—G. C. D.]

107. **Galium aparine**, Curt., *Fl. Lond., fasc. 2, t. 9;* Mart., *Fl. Rust., t. 104; Fl. Dan., t. 495*!

I have been induced to give this common Galium along with the *G. spurium*, to which it closely approaches, and is chiefly distinguished by the seeds, which in this plant are rough, whereas in the other they are smooth and shining.

108. **Campanula rapunculus**, *Eng. Bot., t. 283*!

Found near an old chapel at Dunbarton, by the late Rev. Dr. Walker. I know no other locality for it in Scotland. I have observed it by the sides of hedges near Millbank in the vicinity of London; but it appeared to me hardly indigenous. My specimens are from cultivated plants which agree exactly with those I have seen growing in England.

109. **Campanula glomerata**, *Eng. Bot., t. 90*!

This beautiful plant I have always observed on dry banks. On the banks of the Tay near the Linn of Campsie, Perthshire; on the river Esk, and by the sea coast near Arbroath, Angusshire. On the coast of Fife near Pettycur. Also near Broadsworth, five miles from Doncaster, Yorkshire.

[First record for Perthshire.—G. C. D.]

110. **Silene nutans**, *Eng. Bot.*, *t. 465*; *Fl. Dan.*, *t. 242*!

I first observed this plant in July 1789, on dry banks by the shore near Dunninauld in Angusshire. I have since observed it plentifully on dry banks by the coast in Kincardineshire, from the mouth of the North Water to St. John's Haven, covering a tract of several miles.

[The first Scottish record.—G. C. D.]

111. **Arenaria verna**, *Eng. Bot.*, *t. 512*; Jacq., *Fl. Austr.*, *t. 404*; Vaill., *Bot. Paris.*, *t. 2, f. 3*!

Found abundantly on the rocks of Arthur's Seat and Blackford Hill near Edinburgh, from whence my specimens were collected. A beautiful variety, with double flowers, was shown me by the Rev. Mr. Macritchie in Cluny, found by him in Derbyshire.

112. **Potentilla verna**, *Eng. Bot.*, *t. 37*!

I observed this plant in Mr. Curtis's collection, under the name of *P. opaca*, as a specimen in my possession evidently proves. His *P. verna* appears to me to be a distinct species, which I have never seen except in the neighbourhood of Hewelhall [Hewell Hall], near Bromsgrove in Worcestershire. [*Cf.* No. 14, *P. procumbens*.—G. C. D.] The *P. verna* of "Flora Scotica" said to grow on the Highland mountains is not this plant. There are two species which I have found there, and which appear to me distinct plants. These at some future period I flatter myself I shall be enabled to exhibit in this work.

113. **Ranunculus flammula**, Curt., *Fl. Lond.*, *fasc. 6, t. 37*; *Eng. Bot.*, *t. 387*; *Fl. Dan.*, *t. 575*!

In marshes, common. I have found it requisite to give this Ranunculus along with the *R. reptans*, as some authors have regarded them as varieties of the same plant.

114. **Ranunculus reptans**, *Fl. Dan.*, *t. 108*!

R. flammula δ of *Flora Britannica.*

My specimens were gathered near the west end of Loch Leven, the habitat mentioned by Lightfoot. Some of the starved specimens agree with the figure in the title-page of "Flora Scotica"; but in general they are much stronger, and seem, in my opinion, to run into the *R. flammula*.

115. **Ranunculus lingua**, *Eng. Bot.*, *t. 100*; *Fl. Dan.*, *t. 755*!

Found in the Moss of Restennet, and by the side of the lakes of Rescobie and Turin, plentifully; also in a slow-running rivulet called Lemly, in such abundance as to impede the

current; and other places in Angusshire. It has been observed in Strathearn, by Mr. R. S. Miller, Dupplin House. My specimens were gathered by the side of Duddingston Loch near Edinburgh.

[First record for Perthshire.—G. C. D.]

116. **Brassica rapa,** Mart., *Fl. Rust., t. 49, 50.*

Brassica napus, Lightf., *Fl. Scot., p. 359.*

The specimens of this plant were gathered from the Castle rock of Edinburgh, the habitat mentioned by Lightfoot for *B. napus.*

117. **Geranium sanguineum,** *Eng. Bot., t. 272*!

Found on rocks and dry banks in Scotland, not unfrequent. My specimens were gathered near Burntisland, Fifeshire.

118. **Matricaria chamomilla,** Curt., *Fl. Lond., fasc. 5, t. 63;* Mart., *Fl. Rust., t. 74*!

I have observed this plant as a common weed in nurseries and gardens near London, particularly on the Surrey side. My specimens were gathered near Edinburgh, in cultivated fields, but it may be considered as of rare occurrence in Scotland. I have seen a plant in Fifeshire nearly twice the size of this, the radii always reflexed, the segments of the leaves much broader, and the smell very fragrant. May this be the *Matricaria suaveolens* of English authors?

119. **Satyrium viride,** *Eng. Bot., t. 94; Fl. Dan., t. 77.*

I have observed this plant not unfrequently in various parts of Scotland. As in pastures at Lower near Forfar; also on the top of a hill, in a marsh called the Greens of Fern, Angusshire; in ascending Ben Lawers; near Dupplin in Perthshire; near the upper reservoir on Pentland hills. My specimens were gathered near Burntisland, Fifeshire.

[*Habenaria viridis*, R.Br., the first record for Perthshire. —G. C. D.]

120. **Splachnum mnioides,** Hedw., *St. Crypt., ii., t. 11.*

I have found this moss on Ben-High, or Bennachie, in Aberdeenshire; also on the high mountains of Cairngorm in Inverness-shire. On Loch-na-gare, and the mountains of Clova in Angusshire. It may be considered as of rather rare occurrence.

[*Tetraplodon mnioides*, B. & S.—G. C. D.]

121. **Splachnum fastigiatum.**

Spl. mnioides, Eng. Bot., t. 786.

Spl. Brewerianum, Hedw., *St. Crypt., ii., t. 38.*

This Splachnum may be considered as the most common one. I have found it on all the highland mountains; as likewise in several places in the neighbourhood of Forfar.

[*Tetraplodon mnioides*, B. & S., var. *Brewerianus*, B. & S.—G. C. D.]

122. **Grimmia recurvirostra**, Hedw., *St. Crypt., i., t. 7;* Dill., *Hist. Musc., t. 48, f. 45; Eng. Bot., t. 1438.*

I have met with this moss in Scotland, not unfrequently. In various parts of Angusshire, particularly near Forfar; near Dupplin in Perthshire, also in Breadalbane; in the Wood of Darnway; on the hill of Dunaird, near Brodie House. Between Stonehaven and Aberdeen; also in parts of the neigbourhood of Edinburgh, as in the King's Park, Pentland hills, etc.

[This is now *Barbula rubella*, Mitt.—G. C. D.]

123. **Hypnum ruscifolium**, Hedw., *St. Crypt., iv., t. 4; Eng. Bot., t. 1275;* Dill., *Hist. Musc., t. 38, f. 31, etiam t. 40, f. 44.*

Found in rivulets, not unfrequent; particularly in alpine situations; as in various parts of Angusshire; Ochil Hills, Perthshire; and Pentland hills near Edinburgh.

[This is now *Eurhynchium rusciforme*, Milde.—G. C. D.]

124. **Lichen inclusus**, *Eng. Bot., t. 678.*

I observed this lichen on trees near Balmanna Castle, in Strathearn, also on a holly tree in the wood near Roslin. I received a specimen from the Rev. Mr. Harriman, Durham, which exactly agrees with the specimens here given.

125. **Lichen salicinus**, *Eng. Bot., t. 1305.*

Found on trees in several places in Scotland, but not very common. My specimens were collected at Arniston in Midlothian; in May 1805.

FASCICULUS VI.—1806.

126. **Scirpus palustris.**

[Missing.—G. C. D.]

127. **Scirpus pauciflorus**, Scheuchz., *Agrost., t. vii., f. 19!*

In marshes and boggy places, not unfrequent, as near the east end of the lake at Forfar, moss of Cairnie, near Dupplin,

Perthshire; by the side of Inverkeithing Bay, Fifeshire; Pentland hills, King's Park, and Leith links, Midlothian. My specimens are from the four latter places.

128. **Scirpus multicaulis,** *Eng. Bot., t. 1187; Fl. Dan., t. 167; Rel. Rudb., t. 278, f. 2.*

I have observed this plant in great abundance in marshy places by the river Dee, near Aberdeen; also near Banff. Mr. Smith, nurseryman, near Ayr, and the late Mr. John Mackay, found the same Scirpus on the west coast of Scotland. My specimen is from the Pentland hills, near Edinburgh, where it grows plentifully.

[*Eleocharis multicaulis*, Sm.—G.C.D.]

129. **Scirpus fluitans,** *Eng. Bot., t. 216;* Scheuchz., *Agrost., t. 7, f. 20*!

In ditches and where water has stagnated during winter, not unfrequent. My specimens are from marshes at Duncan Hill, Fifeshire, and Braid hill, near Edinburgh.

130. **Scirpus setaceus,** *Fl. Dan., tab. 311;* Leers., *Fl. Herborn., p. 10, t. 1, f. 6*!

In moist sandy places, not uncommon, as near Forfar and at Dupplin, Perthshire. My specimens are from King's Park, Edinburgh.

[First record for Perthshire.—G. C. D.]

131. **Scirpus maritimus,** *Eng. Bot., t. 542;* Curt., *Fl. Lond., fasc. 4, t. 4*!

On the sea coast near the Sands of Barry and by the side of a rivulet at Teake's Bridge, near Montrose, both in Angusshire. Also on the banks of the Clyde, about four miles above Dumbarton, plentifully. My specimens are from Goulon Links, East Lothian.

132. **Scirpus cæspitosus,** L., *Eng. Bot., t. 1025* !

On heaths and on highland mountains, not unfrequent.

133. **Symphytum tuberosum,** *Eng. Bot., t. 1502*!

By the side of the water of Leith, between Colington and Currie; at Bell's Mills, near Edinburgh; and also at Bilstonburn, near the village of Loanhead, Midlothian, whence my specimens were taken. In all these places it is undoubtedly native.

134. **Azealia procumbens,** Linn., *Fl. Lapp., ii., p. 60, t. 6, f. 2; Fl. Dan., t. 9;* Lightf., *Fl. Scot., 139.*

I have observed this plant on the Highland mountains, not unfrequent; as on Ben Lomond, Ben Lawers, and Ben Schehallion, and other mountains in Breadalbane; Ben Nevis; the high mountains of Cairngorum; also the mountains of Clova in Angusshire; and Loch-na-gare in Aberdeenshire, from whence my specimens are taken.

[*Loiseleuria procumbens*, Desv.—G. C. D.]

135. **Arenaria tenuifolia,** *Eng. Bot., t. 219; Fl. Dan., t. 389*!

I have observed it in Worcestershire, but not common. I have lately found it in Fifeshire, growing in gravelly places not far from Pettycur, but rare. I acknowledge my obligation to Mr. Johnstone of Knaresborough, for some excellent specimens of the plant collected by him in that neighbourhood.

136. **Arenaria fasciculata,** Jacq., *Fl. Austr., ii., t. 182.*

It is several years since I first observed this plant growing on rocks on the mountains of Clova in Angusshire; but very rare. It is but lately that I was able to make up my mind in regard to this species, when I had an opportunity of consulting Jacquin's "Flora Austriaca." I have likewise found it on some rocks in Fifeshire, but rare. My specimens are from Clova in Angusshire.

137. **Arenaria trinervia,** *Eng. Bot., t. 1483; Fl. Dan., t. 429;* Curt., *Fl. Lond., fasc. 4, t. 31*!

In shady places, and woods, not unfrequent.

138. **Doronicum pardalianches,** *Eng. Bot., t. 636;* Jacq. *Fl. Auxr.* [*Austr.*], *t. 350*!

Common in the Den of Dupplin. I have nowhere seen it in such abundance as near Stobhall, about 7 miles from Perth, where it covers upwards of an acre of the ground to the exclusion of every other vegetable. . . . I have likewise noticed it in the neighbourhood of Kinnard, near Brichen, Angusshire.

[First record for Perthshire. It is still plentiful at Stobhall. —G. C. D.]

139. **Senecio viscosus,** *Eng. Bot., t. 32*!

On the shore between Queensferry and Hopetoun; also between Porto-bello and Goulon links in various places; and in the King's Park. My specimens are from the Calton hill, Edinburgh.

140. **Senecio squalidus,** *Eng. Bot., t. 600* !

I have seen this plant in the neighbourhood of Oxford, the habitat mentioned in "English Botany"; but my specimens are from a garden, where they differ in no respect from those in a wild state. I have not had an opportunity of procuring indigenous specimens.

141. **Gnaphalium minimum,** *Eng. Bot., t. 1157.*

Upon walls and dry gravelly places in Scotland, frequent. My specimens are from Figgat Whins, near Edinburgh.

[*Filago minima*, Fr.—G. C. D.]

142. **Atriplex littoralis,** *Eng. Bot., t. 708* !

On the shore between Queensferry and Hopetoun. My specimens were from Goulon Links, East Lothian, where it grows in cornfields, not unfrequent.

143. **Scolopendrium vulgare,** *Eng. Bot., t. 1150.*

Asplenium Scolopendrium of Linn., Huds., With., Hull; Curt., *Fl. Lond., fasc. i., t. 67;* Bolt., *Fil., 18, t. 11.*

On rocks by the sea, Angusshire, where my specimens were collected; also on the side of a well at Dumblane, Perthshire; on a rock at Belgavis, about five miles from Forfar; on rocks on Pentland hills, Edinburgh; and on the old walls of Roslin chapel. I have likewise observed it in a shady lane near Tutnal toll-bar, about three miles from Broomsgrove, Worcestershire.

[First record for Perthshire and Worcestershire.—G. C. D.]

144. **Phascum stoloniferum,** Dicks., *Crypt., fasc. 3., t. 7, f. 2;* Hedw., *Sp. Musc., 24.*

In a marsh near Gordon Castle. I have seen it in several places near Edinburgh. My specimens from a marsh on Braid Hill in the vicinity of that city.

[*Ephemerum serratum*, Hampe.—G. C. D.]

145. **Gymnostomum Donnianum,** *Eng. Bot., t. 1592.*

I first discovered this moss in the Den of Dupplin, five miles from Perth, in November or December, 1779, being then in fruit. I have not been in that place at the proper season since; of course I could not ascertain the plant till, on my return from Ben Lawers, in 1804, I visited the spot, and pointed out the rock on which it grew to Messrs. R. Miller, senior and junior, and desired that pieces of that rock might be sent to me at different seasons; and by their obliging attention I am indebted for the specimens now given.

[*Anodus Donianus*, B. & S.=*Seligeria Doniana*, C. M.—G. C. D.]

146. **Trichostomum fontinalioides**, var. *β*.

Fontinalis alpina of Dicks., With., and Hull, Hedw., *St. Crypt., iii., t. 14*; Dicks., *Crypt., fasc. 2, p. 2, t. 4, f. 1.*

Upon stones in the water of Leith, and at Collington near Edinburgh. My specimens are from the side of Loch Tay, where it grows in great abundance.

[*Cinclidotus fontinaloides*, Beauv.—G. C. D.]

147. **Hypnum sericeum**, *Eng. Bot., t. 1445*; Curt., *Fl. Lond., fasc. 2, t. 59*; Hedw., *St. Crypt., iv., t. 17*; Dill., *Hist. Musc., t. 42, f. 59.*

Upon rocks and walls frequent in Scotland. My specimens are from the neighbourhood of Edinburgh.

[*Pleuropus sericeus*, Dixon.—G. C. D.]

148. **Hypnum curvatum**, *Eng. Bot., t. 566*; Hedw., *St. Crypt., iv., t. 8*; Dill., *Hist. Musc., t. 41, f. 50*; Vaill., *Bot. Paris., t. 28, f. 4.*

In woods in Scotland, frequent. My specimen is from a wood at Burnside, three miles from Forfar, Angusshire.

[*Isothecium myurum*, Brid.—G. C. D.]

149. **Bryum compactum**, *Eng. Bot., t. 1527*; Dicks., *Crypt., fasc. 4, t. 11, f. 11.*

I have observed this moss on Ben Lawers, mountains of Clova and Cairngorum; and, in the beginning of April 1806, I found this plant plentifully in marshes in the King's Park, where my specimens were collected.

[No specimen.—G. C. D.]

150. **Lichen fastigiatus**, *Eng. Bot., t. 890.*

Upon trees in Scotland, plentifully. My specimens are from Caroline Park near Edinburgh.

[*Ramalina fastigiata* (L.).—G. C. D.]

FASCICULUS VII.—1806.

151. **Lycopus europæus**, Curt., *Fl. Lond., fasc. 3, t. 2*; *Eng. Bot., t. 1105*!

This plant is not unfrequent in England; but it may be considered as rare in Scotland. I have observed it plentifully in Worcestershire and Warwickshire. I have seen it by the side of Gairloch, opposite to Greenock, the only habitat I have

discovered in Scotland. It has also been found by Mr. Smith, nurseryman, near Ayr, on the west coast of Scotland.

[The first record for Warwickshire and Worcestershire.—G. C. D.]

152. **Salvia verbenaca,** *Eng. Bot., t. 154;* Curt., *Fl. Lond., fasc. 6, t. 4*!

This plant is found near Salisbury Craigs; near Burntisland; also near Dundee.

133 [153]. **Aira præcox**, Curt., *Fl. Lond., fasc. 3, t. 7; Fl. Dan., t. 383; Eng. Bot., t. 1296*!

On dry barren places, frequent.

154. **Festuca vivipara,** Scheuchz., *Prod., p. 21, t. i., f. 2; Eng. Bot., t. 1355.*

Found on the Highland mountains. My specimens are from Ben Lawers.

[Viviparous *Festuca ovina*, L., first record for Perthshire.—G. C. D.]

155. **Sagina maritima.**

Annua Fl. Maia-Augusta. Radix parva. Caules plurimi, adscendentes, plerumque divar[i]cati, dichotomi. Foliis lineari lanceolatis obtusis, carnosis, nitidis, apice submucronulatis. Calyx ovata obtusus, margine scarioso. Petala minuta, sæpe abortiva, stamina 4 ad 8.

A *Sagina apetala*, foliis latioribus obtusioribus crassioribus sublente hispidis. Vix aut ne vix quid emmucronulatis, calycis foliis ovato-obtusis. Plane differt.

On the sea coast not unfrequent, in Angusshire, Isle of Sky, near Aberdeen, Queensferry and Edinburgh.

[I think this is *S. maritima*, Don, var. *debilis* (Jord.).—G. C. D.]

156. **Sagina apetala,** Curt., *Fl. Lond., fasc. 5, t. 14*!

Found on gravel walks, on wall tops, and dry gravelly places not unfrequent.

157. **Pulmonaria officinalis,** *Eng. Bot., t. 118; Fl. Dan., t. 482*!

My specimens were collected in the woods of Arniston, 12 miles from Edinburgh, where it grows in abundance, as also a variety with white flowers.

[An introduced, not a native species.—G. C. D.]

158. **Asperugo procumbens**, *Fl. Dan.*, *t. 552*!

Found on rocks near the fishing town of Achmithie, miles east from Arbroath, where my specimens were collected. It has also been found by Mr. James Hoy near Brough-head, a supposed Danish fort, on the Moray frith.

159. **Ribes petræum**, Jacq., *Ic. rar.*, *i.*, *t. 49*.

I have again to acknowledge my obligation to the Rev. Mr. Harriman for excellent specimens of this plant collected by him near Egleston in the county of Durham.

[*Ribes rubrum*, L., var. *petræum* (Sm.).—G. C. D.]

160. **Œnanthe crocata**, Jacq., *Hort. Vind.*, *iii.*, *t. 55;* Woodv., *Med. Bot.*, *Suppl.*, *t. 267* !

This plant is common in Strathearn, as also by the side of the river Tay in Perthshire. I have likewise seen it in the neighbourhood of Dundee in Angusshire. It has also been found by Mr. James Hoy near Gordon Castle.

[First record for Perthshire.—G. C. D.]

161. **Phellandrium aquaticum**, Woodv., *Med. Bot.*, *Suppl.*, *t. 266*.

Found in a ditch near Corstorphine as mentioned by Lightfoot, where my specimens were collected. I have never observed it elsewhere in Scotland.

[*Œnanthe Phellandrium*, Lam.—G. C. D.]

162. **Erica Daboëcii**, *Eng. Bot.*, *t. 35*.

I have to acknowledge my obligation to Mr. J. T. Mackay of Dublin for excellent specimens of this plant collected by him in Ireland.

[*Boretta cantabrica*, Kuntze (*Daboëcia polifolia*, D. Don).—G. C. D.]

163. **Paris quadrifolia**, *Eng. Bot.*, *t. 7*; *Fl. Dan.*, *t. 139* !

I have been honoured by Miss Eleanora Campbell with excellent specimens of this plant collected by her in the glen of Kilbryde near Dunblane. I have also received others from Mr. Thomas Bishop, collected in the woods of Methven near Perth. I have likewise observed it in the den of Bethaik [Balthayock, which is Lightfoot's locality for it.—G. C. D.], as also in the woods of Lyndoch, both in Perthshire, and in the grove of Broadsworth, 5 miles from Doncaster in Yorkshire.

164. **Lythrum salicaria**, Curt., *Fl. Lond.*, *fasc. 3*, *t. 28*; *Fl. Dan.*, *t. 671*; *Eng. Bot.*, *t 1061* !

I have observed this plant between Dunkeld and Blair in Athol, and plentifully in the neighbourhood of Paisley, in cornfields and by the sides of ditches. Also near London. It has been found by Mr. R. Miller, Dupplin House, near Newburgh in Fifeshire.

[First record for Perthshire.—G. C. D.]

165. **Potentilla opaca,** Jacq., *Pl. rar. ic. cent., i., t. 49* [91].

I discovered this plant some years ago on the mountains of Angusshire to the west of Clova. I likewise observed what I take to be the same plant on rocks opposite Dundee, in April 1786, near to the place where I found the *Grimmia maritima*. I was at a loss as to this species, till I happened to notice the figure in Jacquin's work, which exactly agrees with my plant. This I believe to be the true Linnean plant. The *P. opaca* of the English authors appears to be the *P. verna*; at least such was the case with the plant cultivated in Mr. Curtis's garden at Lambeth Marsh.

[*P. intermedia*, Nestl.=*P. Nestleriana*, Tratt.—G. C. D.]

166. **Teucrium Scorodonia,** Curt., *Fl. Lond., fasc. 5, t. 40; Fl. Dan., t. 485; Eng. Bot., t. 1543*!

In woods and on rocks, common.

167. **Teucrium chamædrys,** Woodv., *Med. Bot., Suppl., t. 243*!

On old walls, as at Balgavis, five miles east from Forfar, and at Kelly, three miles from Arbroath, both in Angusshire, but always near houses.

168. **Thymus acinos,** Curt., *Fl. Lond., fasc. 1, t. 43; Eng. Bot., t. 411.*

Although this plant is not unfrequent in several parts of England, it must be considered as rare in Scotland. I have only seen it in one place, viz. on a rising piece of ground, near a small village called Welltown, about a mile south of Forfar.

[*Calamintha Acinos*, Clairv. (*C. arvensis*, Lam.).—G. C. D.]

169. **Coronopus Ruellii,** *Fl. Dan., t. 202;* Mart., *Fl. Rust., t. 92.*

In the neighbourhood of Edinburgh, not unfrequent. My specimens were collected near Burntisland in Fifeshire.

170. **Coronopus didyma,** *Eng. Bot., t. 248*!

My specimens are from self-sown plants in a garden. I had no opportunity of procuring wild ones.

171. **Iberis nudicaulis,** Curt., *Fl. Lond., fasc. 6, t. 42; Eng. Bot., t. 327.*

I observed this plant by the side of a hedge a little to the eastward of Kirkintulloch. I likewise found it in dry gravelly fields half a mile south of Forfar. I have seen it nowhere else in Scotland. I have also observed it in cornfields between Ferry Bridge and Doncaster in Yorkshire.

[*Teesdalia nudicaulis,* R.Br.—G. C. D.]

172. **Grimmia recurvata,** Hedw., *St. Crypt., i., t. 38: Eng. Bot., t. 1489.*

I have observed this plant on rocks by the side of the river Neran about 6 miles from Forfar. Also on rocks to the west of Logie Almond in Perthshire; near Roslin, on rocks at Bilston burn; by the side of Bevelaw burn near the foot of Pentland hills.

[*Seligeria recurvata,* B. & S.—G. C. D.]

173. **Grimmia controversa.**

Bryum virens, Dicks.

Br. viridulum, Huds., With., Hull., Curt., and Lightf.; Hedw., *St. Crypt., iii., B., t. 5; Eng. Bot., t. 1367.*

Common in stubble fields on ditch banks, and rocks.

[*Weisia viridula,* Hedw.—G. C. D.]

174. **Grimmia acuta,** Hedw., *St. Crypt., iii., t. 35.*

Bryum acutum of Linn., Hull., and With.

On rocks on the Highland mountains. My specimens are from Ben Lawers.

[*Blindia acuta,* B. & S.—G. C. D.]

175. **Grimmia heteromalla,** Hedw., *St. Crypt., i., t. 8.*

Bryum Weisia, Dicks., With., Hull.

Found on heaths and commons about Forfar, and on banks by the sides of rivulets near the foot of Ben Lawers, and other Highland mountains.

[*Ditrichum homomallum,* Hpe.—G. C. D.]

FASCICULUS VIII.—1806.

176. **Poa distans,** Curt., *Fl. Lond., fasc. 6, t. 1; Eng. Bot., t. 986.*

Found on rocks near Pettycur, Fifeshire; also near Leith.

[*Glyceria distans,* Wahl. = *Panicularia distans,* Kuntze.—G. C. D.]

177. **Rotbollea incurvata,** *Fl. Dan., t. 938; Eng. Bot., t. 760.*

On the sea-coast in several places to the east of North Berwick Law, but rare.

[*Lepturus filiformis*, Trin., var. *incurvatus* (Trin.).—G. C. D.]

178. **Rotbollea filiformis,** Mant., *Gr., p. 23, f. 30;* Barr., *ic., t. 117, f. 1.*

I discovered this truly rare plant on Goulan Links, East Lothian, in August 1804. It grows by the sides of the small pools of water, always among grass. I have never seen it elsewhere.

[*Lepturus filiformis*, Trin. Very weak specimens.—G. C. D.]

179. **Centunculus minimus,** *Fl. Dan., t. 177; Curt., Fl. Lond., fasc. 3; t. 11; Eng. Bot., t. 531!*

I have to acknowledge my obligation to Mr. Sowerby for excellent specimens of this plant. I have observed it sparingly in the neighbourhood of Forfar, also near Comrie in Perthshire. It has likewise been found by Mr. R. Brown on the links near St. Andrews.

[First record for Perthshire.—G. C. D.]

180. **Campanula persicifolia,** *Fl. Dan., t. 1087;* Bolliard [Bulliard], *Herb. Franc., t. 367!*

This beautiful campanula may now be regarded as an addition to the British flora, as I have observed it in woods near Cullen, in July 1802, at which time it was in flower, and appeared to be indigenous. What convinces me the more is, that all the campanulas of this species found in gardens in that neighbourhood were double-flowered. I also enquired diligently if ever it had been seen with single flowers in that country, but was uniformly answered in the negative. I may farther observe, that I have often seen the plant neglected, and to remain without culture for years; but could never observe any variation in its flowers. It may therefore be concluded that this plant is truly indigenous.

[The first record for Scotland, but only as a naturalised, not a native plant.—G. C. D.]

See Journ. Bot., 289 (1903).

181. **Chrysosplenium alternifolium**, *Eng. Bot., t. 54: Fl. Dan., t. 366!*

Found in moist shady places; as at Bilston burn, near Loanhead, 7 miles from Edinburgh; also in a deep shady den called Burn of Old Whary, and in another called Cox Burn,

both in the neighbourhood of Dunblane; and in several places in Angusshire.

My specimens were collected in the Den of Dupplin, Perthshire, by Mr. R. Miller.

182. **Chrysosplenium oppositifolium,** Curt., *Fl. Lond., fasc. 2, t. 27; Eng. Bot., t. 480; Fl. Dan., t. 365*!

In moist places, common.

183. **Saponaria officinalis,** Curt., *Fl. Lond., fasc. 2, t. 29; Fl. Dan., t. 543; Eng. Bot., t. 1060*!

I observed this plant near the village of Red Ditch in Worcestershire, and also not far from Dunblane, in Perthshire. It has been found by Mr. Edward Maughan on the road leading from the Dean to Ravelston.

[First record for Perthshire, and it still exists in the locality, but already recorded for Worcestershire in Withering.—G. C. D.]

184. **Draba verna,** *Fl. Dan., t. 983;* Curt., *Fl. Lond., fasc. 1, t. 49; Eng. Bot., t. 586.*

On walls and dry sandy places, common. The right hand or outer specimen is a singular variety, which some time hereafter may be considered as a distinct species. This is found not unfrequent in the neighbourhood of Forfar in Angusshire.

[The specimen referred to by Don is too young to name except as aggregate *Erophila vulgaris*, DC., the other specimen approaches *Erophila stenocarpa*, Jord.—G. C. D.]

185. **Draba hirta,** *Eng. Bot., t. 1338.*

Draba pyrenaica of Fl. Dan., t. 143.

My specimens are from rocks on the summit of Ben Lawers. I have never seen it anywhere else.

[*Draba hirta*, L., var. *rupestris* (R.Br.).—G. C. D.]

186. **Draba aizoides,** Jacq., *Fl. Aust., ii., t. 192;* Curt., *Bot. Mag., t. 170; Eng. Bot., t. 1271*!

My specimens are from cultivated plants; but will be found to differ in no respect from those found wild in Wales.

187. **Draba incana,** *Eng. Bot., t. 388; Fl. Dan., t. 130*!

On rocks on the summits of the Highland mountains. My specimens were collected from Ben Lawers, Loch-na-gar, and the mountains of Cairngorum.

[First record for Perthshire.—G. C. D.]

188. **Draba muralis,** *Pet., Herb. Brit., t. 48, f. 5; Eng. Bot, t. 912*!

In a field behind the Botanic Garden, Edinburgh, where my specimens were collected. It has likewise been found by Mr. Robertson at Bellevue near Edinburgh, and appears to be indigenous there.

189. **Carex teretiuscula,** *Trans. Linn. Soc., ii. (1794), t. 19, f. 3; Eng. Bot., t. 1065.*

On the Pentland Hills near Edinburgh. My specimens are from the neigbourhood of Forfar, where it grows plentifully.

[*C. diandra*, Schrank (*C. teretiuscula*, Good.), which is still plentiful at Rescobie near Forfar.—G. C. D.]

190. **Carex pulla,** *Trans. Linn. Soc., iii. (1797), t. 14.*

I first observed this plant on Ben Lomond in 1789, and on Ben Lawers in 1798, and on Ben Nevis in 1794. I sent specimens of this plant to Mr. Dickson of Covent Garden in 1794; and I have a letter of that date in which Mr. Dickson acknowledges it to be a nondescript. How he afterwards considered himself to be the discoverer of this plant I cannot explain. If Mr. Brown's information be correct, the Rev. Mr. Stewart of Luss had been acquainted with this plant some years before.

[*C. saxatilis*, L. First recorded for Perthshire in Trans. Linn. Soc., iii. (1797), p. 78.—G. C. D.]

191. **C. pilulifera,** *Fl. Dan., t. 1048; Eng. Bot., 885*!

On heaths not uncommon, and on the summit of Arthur's Seat and Pentland Hills near Edinburgh. My specimens are from the neighbourhood of Forfar, where it grows abundantly.

192. **Carex stricta,** *Trans. Linn. Soc., ii. (1794), t. 21, f. 9.*

Carex cespitosa, Huds. and Lightf., var. b.

Carex acuta, a, Leers, Fl. Herborn., p. 207, t. 16, f. 1; Eng. Bot., t. 914.

I have seen this Carex in several places in Scotland; but it is of the rarer species. My specimens were collected from the side of the river Esk, near Eskmount, three miles from Brichen in Angusshire.

[This is *Carex aquatilis*, Wahl., var. *elatior*, Bab., the first British record, and the first clearly ascertained specimen known, I believe, for Britain.—G. C. D.]

193. **Carex vesicaria.**

C. inflata of Lightf., Huds.; *Fl. Dan., t. 647: Eng. Bot., t. 1770*!

I have seen it by the side of the river near the foot of Mount Alexander, at the foot of Ben Schehallion, and near Finlarig at the head of Loch Tay. My specimens are from a marsh near Tullybanachar, about three miles [one mile—G. C. D.] from Comrie in Perthshire.

[First record for Perthshire.—G. C. D.]

194. **Carex curta.**

C. brizoides, Huds.

C. canescens, Lightf., *Fl. Dan.*, *t. 285*; *Eng. Bot.*, *t. 1386.*

This carex is not uncommon in marshes in Scotland, as in the neighbourhood of Forfar.

[*C. canescens*, L.—G. C. D.]

195. **Carex arenaria,** *Eng. Bot.*, *t. 928*!

Sea-coast of Angusshire, but rare; chiefly in marshes.

196. **Carex divisa,** *Trans. Linn.* [*Soc.*], *ii. (1794)*, *p. 19*, *f. 2*; *Eng. Bot.*, *t. 1096*!

Sea-coast of Angusshire, but rare; chiefly in marshes.

[*C. divisa*, Huds. recently refound near Arbroath. The first Scottish record.—G. C. D.]

197. **Pilularia globulifera,** D.C. [*Eng. Bot.*], *t. 521*; *Fl. Dan.*, *t. 223*; Dill., *Hist. Musc.*, *t. 79*!

In marshes, not unfrequent, as in a marsh near Gordon Castle; also near Bellmount in Angusshire; Moss of Cairny, near Dupplin, and in the Moss of Balgoune, both in Perthshire. My specimens from the market muir, near Forfar.

[New to Perthshire.—G. C. D.]

198. **Hypnum lutescens,** *Eng. Bot*, *t. 1301*: Hedw., *St. Crypt.*, *iv.*, *t. 16.*

I have observed it, not unfrequent, in the neighbourhood of Forfar, but seldom producing capsules. I have to acknowledge my obligation to Mr. Edward Maughan for excellent specimens collected by him at Caroline Park, near Edinburgh.

[Now known as *Camptothecium lutescens*, B. & S.—G. C. D.]

199. **Fucus dentatus,** *Fl. Dan.*, *t. 354*; *Eng. Bot.*, *t. 1241.*

Cast up on the shore of Leith, not unfrequent, as also on the coast of Angusshire.

200. **Fucus alatus,** *Fl. Dan.*, *t. 352.*

Cast up on the shore of Leith, not unfrequent, and also on the coast of Angusshire.

FASCICULUS IX.—1806.

[Not issued before 1812, but probably either at the end of 1812 or early in 1813, since the Eng. Bot. plate *Myosotis rupicola* issued in 1813 is not cited.]

201. **Hippuris vulgaris,** *Eng. Bot., t. 763*; Curt., *Fl. Lond., fasc. 4, t. 1*! Mare's tail.

In ditches and peat holes, not unfrequent, as in the neighbourhood of Forfar.

202. **Veronica fruticulosa,** *Eng. Bot., t. 1028.* Flesh-coloured Shrubby Speed-well.

My specimens are from the garden wall at Colinton, where it was planted by the late Reverend Dr. Walker, who, we understand, brought it from Ben Cruachan, a high mountain in Argyleshire. I have never seen it on Ben Lawers, and I have no doubt but the *Veronica saxatilis* has been mistaken for it.

[Not a native of Britain.—G. C. D.]

203. **Schœnus fuscus,** *Eng. Bot., t. 1575* [*Mar. 1, 1806*], Moris. [*Pl. Hist. Univ., Oxon., Pars., sec.*], *p. 8, t. 11, f. 40.*

For the specimens of this plant I am indebted to Mr. J. T. Mackay, of Dublin, who collected them in a wet bog near Purple Mountain, Killarney; and at the bottom of the hill of Capil, Cunnamara, and also between Ballynahinch and Oughterard, in 1805.

[This is *Rynchospora fusca*, R. & S.—G. C. D.]

204. **Potamogeton compressus,** *Eng. Bot., t. 418; Fl. Dan., t. 203.* Flat-stalked Pondweed.

In the lake of Rescobie and also in the lake of Forfar. Elsewhere I have never observed it.

[This is *Potamogeton zosterœfolius*, Schum., and the first certain Scottish record.—G. C. D.]

205. **Myosotis alpinus.**

Myosotis cæspetosis, radix perenne foliis radicalibus ovatis oblongis petiolatis, caulinis lanceolatis subamplexicaulibus, floribus fasciculatis amplioribus cyaneus.

This species differs from the *Myosotis scorpioides*, and all its varieties, in being a perennial; and from the *Myosotis palustris*, in having its radical leaves supported on slender petioli, ciliated; as are also the leaves; the hairs on the growing plant bent backwards. The radical leaves of *M. palustris* are lanceolated and can be hardly said to have a petiolus. The

leaf only is somewhat narrower at its base; and when ciliated, the hairs are pointed forwards in the growing plant. I find, on examination, that the hairs of the *Myosotis alpinus*, when the plant is dried, are bent in various directions. This beautiful plant adorns the rocks on the summit of Ben Lawers, producing its flowers during the greater part of the summer.

[The first published record for Britain of the plant now known as *Myosotis alpestris*, Schmidt.—G. C. D.]

206. **Pulmonaria maritima,** *Eng. Bot., t. 368;* Curt., *Fl. Lond., fasc. 6, t. 18.* Sea Lungwort.

On the sea-coast, as at Tornshaven and near Auchmithie, both in Angusshire, and near [St.] Johnshaven, in the shire of the Mearns, plentifully, as also a variety with green leaves.

[*Pneumaria maritima*, Hill; *Mertensia maritima*, S. F. Gray. —G. C. D.]

207. **Chærophyllum aureum,** *Eng. Bot., t. 2103* (*1810*)! Golden Cow Parsley or Cow-weed. Golden Chervil.

I discovered this rare plant, several years ago, by the sides of corn-fields between Montrose and Arbroath. I afterwards found a few plants near Corstorphine, within four miles of Edinburgh. I observed what I believe to be an intermediate plant between this and the *Chærophyllum sylvestre*, near the village of Kirkliston, about ten miles west from Edinburgh.

[Not a British species, and now apparently lost in all the localities.—G. C. D.]

208. **Scheuchzeria palustris,** *Eng. Bot., t. 1801* ! Marsh Scheuchzeria, or Lesser Flowering Rush.

I have to acknowledge my obligation to the Rev. J. Dalton at Copegrove, near Knaresborough, Yorkshire, who collected excellent specimens of it in a marsh near Wetherby, in that county, and kindly communicated the same to me.

[*See* Journ. Bot. 167 (1903).—G. C. D.]

209. **Vaccinium oxycoccus,** *Eng. Bot, t. 319: Fl. Dan., t. 80.* Cranberry.

I have again to acknowledge my obligations to Miss Eleanora Campbell for excellent specimens of this plant collected by her near Kilbryde, within three miles of Dunblane, in Perthshire. I have seen this plant in the neighbourhood of Forfar, and near Loch Brandy in the Clova mountains; but it is not common on the Highland mountains. I have seen it also near Loch Katrine. It is not rare in the South of Scotland or the North of England.

[*Oxycoccus quadripetala*, Gilib.=*O. palustris*, Pers., *Schollera Oxycoccus*, Roth.—G. C. D.]

210. **Polygonum fagopyrum,** *Eng. Bot.*, *t. 1044* Buck-wheat.

In cornfields; but I think it can hardly be considered indigenous.

[*Fagopyrum esculentum*, Moench.—G. C. D.]

211. **Cerastium aquaticum,** *Eng. Bot.*, *t. 538;* Curt., *Fl. Lond.*, *fasc. 1, t. 34.* Water Chickweed.

This, though a common plant in many parts of England, is nevertheless a very rare plant in Scotland. I have never seen it but in one place, viz., in the neighbourhood of Dundee, and here it was extremely rare. It is very common near Birmingham, and also near Bromsgrove, in Worcestershire.

[This is *Stellaria aquatica*, Scop., and the earliest record for Warwickshire and Worcestershire.—G. C. D.]

212. **Cerastium arvense,** *Eng. Bot.*, *t. 93;* Curt., *Fl. Lond.*, *fasc. 6, t. 29*! Field Chickweed.

In fields in the neighbourhood of Forfar, and near Broadsworth, about five miles from Doncaster, in Yorkshire.

213. **Astragalus campestris,** Haller, *Hist.*, *i.*, *p. 177, t. 13.* Field Milk Vetch.

I discovered this truly beautiful species, new to Britain, on a rock on the Clova mountains in July 1812. I have a specimen in my herbarium collected abroad (I believe from Switzerland) which agrees exactly with those I have found on the Clova mountains; and Dr. Smith informs me he has plenty of Swiss specimens which differ in no respect from mine, and that he has others from Oeland differing only in being smaller and more silky. I have seen some of them of that appearance. Although named *campestris* by Linnæus, it is truly an alpine plant.

[This is *Oxytropis campestris*, DC., of which Don was, as he says, the discoverer as a British plant.—G. C. D.]

214. **Satyrium albidum,** *Eng. Bot.*, *t. 505; Fl. Dan.*, *t. 115.* White Satyrion.

In dry, hilly pastures, as in the Forest-muir near Forfar, and in the Glen of Ogilvie near Glammis. My specimens are from the Clova mountains.

[This is *Habenaria albida*, R. Br.—G. C. D.]

215. **Carex rariflora** of Wahlenberg, in the "Stockholm Transactions," *Carex limosa*, var. γ of Willdenow. Thin-flowering Carex.

I discovered this species, new to Britain, on the summit of the Clova mountains in July 1807, in wet places, where the snow remains during the greater part of the year.

[*C. rariflora*, Sm.—G. C. D.]

216. **Carex salina** of Swartz. Salt-marsh Carex.

I discovered this species, new to Britain, on rocks on the high mountains of Cairngorum in August 1802. I have since observed it on rocks on the Clova mountains. My specimens from Ben Macdowie [Mac Dhu], a high mountain near the head of the river Dee, collected in September 1812. Dr. Smith tells me that Swartz sent him this as a new species from the sea-coast of Norway, latitude 71°.

[This is not *C. salina* but *C. vaginata*, Tausch, of which Don was the first discoverer in Britain.—G. C. D.]

217. **Carex rigida,** *Fl. Dan., t. 159*! Rigid Carex.

On the summit of the Highland mountains; common.

218. **Carex limosa,** *Fl. Dan., t. 646*! Green and gold Carex, or Mud Carex.

In marshes. Not unfrequent in the neighbourhood of Forfar. I have also seen it on the mountains between Loch Erne and Loch Tay.

219. **Equisetum sylvaticum,** *Eng. Bot., t. 1874; Fl. Dan., t. 1182*! Branched Wood Horse-tail.

In most [moist] shady places and woods. Not unfrequent in Angusshire.

220. **Fontinalis squamosa,** Dill., *Hist. Musc., p. 258, t. 33, f. 3.* Shining Scaly Water-Moss.

In alpine rivulets. My specimens from a rivulet that runs from Loch Brandy, on the Clova mountains.

[Mr. H. N. Dixon has examined the specimen and says it must be *F. antipyretica*, var. *gracilis*, on account of the distinctly keeled leaves. The general appearance, capsules, &c., are much like *F. squamosa*.—G. C. D.]

221. **Hypnum molluscum,** Dill., *Hist. Musc., t. 36, f. 20*! Plumy-crested Feather-Moss.

On dry, upland situations, and in marshes; but it is only in the latter situations where it produces its capsules freely.

222. **Hypnum crista-castrensis,** *Eng. Bot., t. 2108* !

I discovered this beautiful species about twenty-five years ago in fir woods near Forfar. It was not known for several years after to be a native of Britain. It was not until September 1812 that I found it with capsules in a wood opposite Mar Lodge, by the side of the river Dee, in Aberdeenshire.

223. **Hypnum schreberi,** *Eng. Bot., t. 1621* ! Schreberian Feather-Moss.

On the Pentland hills, and in a wood opposite Mar Lodge. My specimens from fir woods near Forfar.

224. **Hypnum purum,** *Eng. Bot., t. 1599 ;* Curt., *Fl. Lond., fasc. 3, t. 65 ;* Dill., *Hist. Musc., t. 40, f. 45* !

Neat Meadow Feather-Moss.

Not unfrequent. My specimens from fir woods near Forfar.

[*Brachythecium purum,* Dixon.—G. C. D.]

225. **Lichen nivalis,** Linn., *Eng. Bot., t. 1994.*

Cetraria nivalis, *Ach. Meth., p. 294; Fl. Dan., t. 227 ;* Dill., *Hist. Musc., t. 21, f. 56.*

On the summit of the very highest mountains—as on the Cairngorum, Ben Macdowie, Cairn Towel, and Ben-na-Board, and other high mountains north of the river Dee; and on Loch-na-gare and others in the neighbourhood; and on the Clova mountains. I have never seen it on Ben Lawers nor on any mountains of the West Highlands.

APPENDIX D.

GEORGE DON'S PRIVATE HERBARIUM.

(DATE, 1809–1813.)

This is contained in a large folio volume which was purchased by Mr. Blackadder, land surveyor, Glamis, at the sale of George Don's effects in the spring of 1814. After his death it came into the possession of his nephew, Robert Blackadder, civil engineer, Dundee, from whom John Knox purchased it in April 1881.

It contains a number of grasses, sedges, and rushes, often, however, without precise localities. In some cases the name of the plant and even the locality is put in without the specimen to represent it, so that the value attaching to the localities of the species represented is somewhat diminished, and may be the source of error, as we see is the case with another botanist—Dickson—who followed the same plan.

In the following list only those plants which are localised, and which are not represented in the *Herbarium Britannicum* which Don issued, will be given unless they possess some peculiarity worth notice.

Schœnus rufus var.

Salt marshes.

[This is the plant with a long bract, so that the inflorescence appears axillary and not terminal, to which the name *Scirpus rufus*, Schrad., var. *bifolius* (Wahl.), is given in our lists.—G. C. D.]

Scirpus glaucus.

Near Montrose, but rare.

[This is *Scirpus Tabernæmontani*, Gmel.—G. C. D.]

Eriophorum alpinum, L.

It formerly grew in the Moss of Ristenet, near Forfar, but is now lost there, and at present we know of no British habitat. I discovered it in 1791.

Eriophorum capitatum.

On Ben Lawers and the Clova mountains. I discovered this in 1810.

[This is a small form of *E. vaginatum*, L., not *E. capitatum*, Host, which is synonymous with *E. Scheuchzeri*, Hoppe, as the stems are decidedly trigonous, not triquetrous, and the bracts are greyish-green, not black.—G. C. D.]

Eriophorum gracile.

On Ben Lawers and the Clova mountains. I discovered this in 1810.

[This is a small form of *E. angustifolium*, Roth, not the *E. gracile* of Koch. The pedicel-branches are quite glabrous. —G. C. D]

Phleum Michelii.

On rocks on the Clova mountains, but rare. I discovered this in 1808. It has been found nowhere else in Britain.

[Correctly named. The specimen appears to be a cultivated one, being nearly 24 inches high. Its re-discovery would be extremely interesting, as it is not known for Scandinavia.—G. C. D.]

Alopecurus alpinus.

On Loch-na-gare and on the high mountains of Clova; it has been observed nowhere else in Britain.

Milium effusum.

In woods, but not common, as near Airly Castle.

Aira gracile, nova species.

On heaths and pastures.

[A slender form of *Deschampsia cæspitosa*, with longer leaves than the type, and the culm and sheath not asperous.—G. C. D.]

Aira laevigata, nova species.

I discovered this on the Clova mountains in 1808; until then it had not been observed.

[This is probably *Deschampsia alpina*, but as the flowers are viviparous, one is unable to ascertain the position of the awn insertion.—G. C. D.]

Aira flexuosa var.

This from Ben Lawers.

[This is *Deschampsia flexuosa*, Trin., var. *montana* (Huds.)—G. C. D.]

Aira scabra, Setacea of Knapp, *Gram. Brit.*

On heaths where water has stood through winter.

[This is *Deschampsia discolor*, Roem. & Schult.—G. C. D.]

Poa alpina, var. b.

This variety on the Corby Craig, parish of Tomaden (?).

[A luxuriant form of *Poa alpina*. David Don describes a variety of *alpina* as var. *glomerata*, and this may be what he meant.—G. C. D.]

Poa glauca.

On rocks in Angusshire, but rare.

[Not *P. glauca*, Sm., but a glaucous form belonging to the *nemoralis* group, slightly approaching *P. Balfourii*. He sent true *glauca* to Smith in 1810 from Ben Lawers. See *Herb.*, Smith.—G. C. D.]

Poa flexuosa.

On Ben Nevis and Loch-na-gare, two of the highest mountains in Scotland.

[The solitary specimen evidently came from Loch-na-gar, and is my *P. alpina*, L., var. *acutifolia*, as are some of his Ben Nevis specimens in *Herb.*, Smith.—G. C. D.]

Poa cæsia.

On rocks on Ben Lawers.

[*P. cæsia*, Sm. Don also sent Ben Lawers *P. cæsia* to Smith after the plate in *English Botany* was drawn. It is in *Herb.*, Smith.—G. C. D.]

Poa trivialis, var. b.

P. setacea, of Hudson.

[This is *P. trivialis*, L., var. *Koeleri*, Doell.—G. C. D.]

Poa humilis var.

On walls.

[This is *P. pratensis*, L., var. *subcærulea* (Sm.)=*P. humilis*, Ehrh.—G. C. D.]

Poa pratensis var.

On upland pastures.

[A form with large florets near to *P. subcœrulea*, Sm.—G. C. D.]

Poa anceps.

A new species on rocks, but rare.

[In *Herb.*, Smith, this is localised from the Clova mountains. It appears to be an intermediate of *P. Balfourii* and *nemoralis*, but requires further study.—G. C. D.]

Poa depauperata, nova species.

On rocks near the sea at Dundee.

[= *P. leptostachya*, D. Don, in *Mem. Wern. Soc., iii., p. 299* (1821). Banks of the Tay to the west of Dundee. Geo. Don, who cultivated it under the name of *depauperata* for many years. It is a monstrosity, not a species, having something of the habit of P. *compressa*, but the florets are quite malformed. *See* Journ. Bot. 177 (1903).—G. C. D.]

Poa, nova species.

Near Arbroath.

[*Glyceria* species probably.—G. C. D.]

Poa, nova species.

This rare species I discovered near Arbroath.

[*Glyceria* species probably.—G. C. D.]

Briza maxima.

At Newington Butts near London.

[A casual, of course.—G. C. D.]

Dactylis glaucous. Of the Continental catalogues, as I suppose . . . . . it seems a very different species from the *D. glomerata*. On the sea-coast not unfrequent.

[It is a robust glaucous form of *D. glomerata*.—G. C. D.]

Festuca glauca.

On the sea-coast.

[A form of *Festuca rubra;* not the *F. glauca* of Lamarck.—G. C. D.]

Festuca duriuscula var.

On rocks.

Festuca cæsia.

In pastures.

[This is a form of *F. rubra*.—G. C. D.]

Festuca dumetorum of Linn.

F. duriuscula of Smith, *Flora Britannica*, on rocks in the Highlands.

[This is *F. rubra*, L.—G. C. D.]

Festuca prostrata, nova species.

By the sea-side near Arbroath.

[*F. rubra*, L., f.—G. C. D.]

Festuca triflora.

By the side of the Lake of Clunie, but rare.

[It is *Bromus giganteus*, L., var. *triflorus* (Sm.). The earliest record for Perthshire.—G. C. D.]

Festuca longifolia, nova species.

On the banks of rivers.

[This is a form of *Festuca arundinacea*, Schreb.—G. C. D.]

Bromus mollis, b.

This variety on upland pastures.

[A small form of *Bromus hordeaceus*, L., var. *glabratus* = *B. mollis*, L., var. *glabratus*, Doell.—G. C. D.]

Bromus arvensis.

Cornfields, but rare.

[This is *Bromus commutatus*, Schrad.—G. C. D.]

Bromus sericeus, nova species.

On dry banks by the sea-shore.

[This is *Brachypodium gracile*, Beauv. var.—G. C. D.]

Avena poafolia.

A nondescript on dry banks on the river Melgond near Airly Castle.

[A form of *Avena pratensis*, L.—G. C. D.]

Avena planiculmis.

Rocks on the Clova mountains. I discovered this in 1808; till then it was unknown to British botanists.

[This is *Avena alpina*, Sm.—G. C. D.]

Arundo riparia.

On the banks of a river near Montrose. New to Britain.

[A form of *Phragmites communis*, Trin.—G. C. D.]

Arundo stricta.

In a marsh called the White Mire near Forfar. I discovered it in 1808. It has never been observed anywhere else in Britain.

[This is *Calamagrostis stricta*, Nutt. = the *Deyeuxia neglecta* of Kunth.—G. C. D.]

Rottboellia filiformis.

On Goulon Links, East Lothian.

[*Lepturus filiformis*, Trin.—G. C. D.]

Rottboellia incurva.

By the sea-side near North Berwick Law.

[*Lepturus filiformis*, Trin.—G. C. D.]

Triticum cristatum.

On dry banks between Arbroath and Montrose, but rare.

[Also a "var." The latter appears to be a cultivated form of the former.—G. C. D.]

Juncus filiformis.

On the Sands of Barrie and near Montrose.

[This is *Juncus balticus*, Willd.—G. C. D.]

Juncus gracilis.

The only place we are acquainted with where this rush grows in Britain is on the Clova mountains, but rare.

[This is a form of *J. tenuis*, Willd.—G. C. D.]

Juncus bulbosus var.

Salt marshes.

[Is *Juncus Gerardi*, Lois.—G. C. D.]

Juncus campestris.

As it grows in marshes.

[This is *Juncoides multiflorum*, Druce = *Luzula multiflora*, Lej.—G. C. D.]

Carex straminea.

In moist woods by the river Esk in Angusshire, rare; not found anywhere [else] in Britain.

[This is a starved form of *Carex remota*.—G. C. D.]

Carex divisa.

Near Montrose.

[There is no specimen attached to the sheet; but specimens correctly named were distributed by Don in his *Herbarium Britannicum*, No. 196, and it has recently been refound there.—G. C. D.]

Carex muricata var. or species.

Dry banks on the hills of Turin and Tenhaven.

[Probably a young specimen of *C. muricata*.—G. C. D.]

Carex nivalis, nova species.

I discovered this new species on the summit of those mountains at the head of the Doll on Clova in 1807. It has never been found elsewhere.

[This is *Carex rariflora*, Sm.—G. C. D.]

Carex pendula.

By the side of the river Isla above Airly Castle and near Roslin.

Carex depauperata.

Woods in the west of Scotland, but rare.

[There is a probability of this being a slip of the pen for the west of England; its occurrence in Scotland at any time is very doubtful. In this volume the localities were written in before he obtained specimens, and in some cases the blanks were never filled in, as in the case of *Carex Pseudo-cyperus*, which is localised "in woods at Hamilton, rare."—G. C. D.]

Carex atrata.

On rocks on Clova mountains and on other Highland mountains.

Carex pulla.

On Ben Lawers and Ben Nevis.

[This is young *C. saxatilis*, which is synonymous with *C. pulla*.—G. C. D.]

Carex fulva var.

[This is *Carex xanthocarpa*, Déség.—G. C. D.]

Poa compressa, L.

[Two specimens—one from Dundee, the other from Dupplin, Perthshire, for which counties this is the earliest record—are preserved in the herbarium of the Linnean Society. Don thought they were distinct, as he had cultivated both for years. —G. C. D.]

P. pratensis var.

"Walls at Edinburgh, with narrower leaves, which it retains in cultivation. I suppose this to be your var."—Don, in *Herb. Linn. Soc.*

[It is not quite *P. angustifolia*, L.—G. C. D.]

APPENDIX E.

OBSERVATIONS on some of the Indigenous Grasses of Britain, which seem deserving of Culture for Pasture or Hay.[1]

By Mr. GEORGE DON, Gardener,
Botanic Garden, Edinburgh.

Ducente Naturâ, sequar.

INTRODUCTORY REMARKS.

That the reader may be enabled to form an idea of the opportunities enjoyed by the author, of investigating the subject on which he presumes to offer some remarks in the following essay, it will be necessary for him to give a very short account of his professional pursuits and habits of life.

[1] This essay is reprinted from Transactions of the Highland Society of Scotland, vol. vii. (1807), p. 194. I am indebted to Mr. James Macdonald, F.R.S.E., Secretary of the Highland and Agricultural Society of Scotland, for the following memorandum explanatory of the circumstances in which it was written by George Don :—

"In the year 1805 the Highland and Agricultural Society advertised amongst other premiums a Piece of Plate value 20 Guineas for the best Essay on 'Our Native Plants and Grasses,' a Committee being appointed as usual to examine the Essays sent in.

"This Committee presented its Report at a Meeting of the Directors of the Society on 10th January 1806, and from the Minutes of that Meeting it is learned,

(1) that the Piece of Plate value 20 Guineas was awarded to the Rev. W. Singers, Minister of Kirkpatrick, near Moffat, for his Essay on 'Our Native Plants and Grasses,' and

(2) that a Piece of Plate value 15 Guineas was awarded to 'Mr. George Don of the Botanical Garden, Edinburgh,' for an Essay on the same subject.

"In a Minute of a Meeting of the Publications Committee held 4th March 1806 there is this note :—

'The Depute Secretary laid before the Committee an addition given in by Mr. Don 'to his Essay on Our Native Plants, &c., pointing out such as are not proper to be 'cultivated.'

"The Minutes of a Meetlng of the same Committee held April 3, 1806, show that it was then arranged that the Essays by both Singers and Don be published in the 3rd volume of 'Transactions' (1807)."

In the early period of his life, and as far back as his recollection can reach, the author of the following observations felt an irresistible, and almost instinctive attachment to the delightful objects of the vegetable kingdom. This ardent desire, for attaining a knowledge of plants, encreased with his years. No motives of interest, or even the stimulus of emulation, but an invincible propensity to botanical study, induced him to abandon, in a great measure, the more ordinary paths of industry, and devote himself chiefly to his favourite pursuit. Even now, however agreeable in some respects the situation which he occupies may be to his wishes, it is by no means lucrative; he is nevertheless proud to acknowledge the kind and liberal notice of some of the most eminent naturalists in Britain, who have honoured him with their friendship and protection[1]. At his outset in life, he formed the arduous (although to him pleasing,) resolution of visiting every corner of his native country, in search of its vegetable productions; and for twenty-five years past, he has been in the practice of making several botanical excursions every year; particularly to the alpine districts of the Highlands, where he has spent many days and even nights with pleasure, among the lofty cliffs, far from any human habitation, animated by the attainment, or by the hope of botanical discoveries.

These excursions he intends to repeat annually, to such extent as his circumstances may hereafter enable him to accomplish.

Throughout the whole course of his professional investigations, the author considered the *Gramina* of Britain as favourite objects of study, and worthy of his most persevering attention. He has had the satisfaction of examining nearly the whole of them in their native soils and situations; and he has moreover been fortunate enough to add several of them, as well as other plants, to the catalogue of the British *Flora*. Most of these have found a place in Dr. Smith's *Flora Britannica*, and Sowerby's English botany.

Sect. I.

ON THE ADVANTAGES OF CULTIVATED HERBAGE, AND PARTICULARLY OF INDIGENOUS GRASSES.

In every soil and climate, the spontaneous productions of the earth are inadequate to the purposes of husbandry. Nature equally favours all her vegetable productions, whether fitted for the use of

[1] Among these he takes the liberty to mention the names of James Brodie, Esq. M.P. Dr. Smith of Norwich; Dawson Turner, Esq. of Yarmouth; Dr. Scott of Dublin, and Mr. Templeton of Belfast.

man or for other ends: hence arises the great utility of cultivation, not only of the various grains, but of grasses and other herbage for cattle. Even the ancients were well acquainted with the culture of grass crops: Virgil says,

> Vere fabis satio; tum te quoque, *medica*, putres
> Accipiunt sulci; et *milio* venit *annua* cura.
>
> *Vid. Georg.*

In this enlightened age, when agriculture is become a regular science, and studied and practised as such by men of eminent abilities, especially in Britain, loose and speculative theories on agricultural subjects should have no place. Nothing can be admitted that is not founded on facts and experiments. Though many learned and excellent treatises have appeared, on the culture of indigenous and other grasses, yet much remains to be done, and much information is still wanted on this very interesting subject.

In the present advanced state of botanical science in Britain, scarcely any one can be in danger of mistaking the species of the *gramina* used, or proposed to be used, in cultivation. With the writings of Drs *Withering* and *Smith* in one hand, and the figures of *Curtis*, *Knap*, &c. in the other, a moderate share of attention will enable any person to discriminate the ordinary grasses. Those grasses that are less known may be examined in the form of a *hortus siccus*, which can never fail to remove every doubt, as the *gramina* are peculiarly adapted for being preserved in the dry state. Even the seeds of the most eligible may be obtained in small quantities.

In selecting the different species of grasses, suited to different soils and situations, nature is our sure guide. Who would hesitate to pronounce, that a plant found at the summit of the Highland alps, would be the most eligible for cultivation in high situations? Who would question the success of a marsh plant in a wet boggy soil? Although some useful plants are said to grow in any soil or situation, yet we must always except such *habitats* as are adverse to their nature. The pertinacity of some plants to their peculiar soil or situation, is much greater than is commonly supposed. Of this I shall adduce an instance or two.

The *Aira flexuosa*[1] prefers a dry barren soil. About twelve or fourteen years ago, I discovered a similar *Aira* near Forfar, the specific name of which might be *Aira uliginosa*, from its being always found in a wet marshy soil. Both this *Aira* and the *A. flexuosa*

[1] Waved mountain hair grass.

choose a barren soil. I have repeatedly tried to cultivate them on a rich soil, but could never succeed. I have tried the *A. uliginosa* on a *dry* barren soil, and the *A. flexuosa* on a *wet* barren soil, also without success; but I succeeded well when each was placed in the soil indicated by nature[1].

The only other instance I shall here mention relates to the *Poa flexuosa*[2], a grass which I discovered in June 1794, growing among stones near the summit of Ben Nevis. I have tried to cultivate this Poa in good soil, but my efforts proved abortive in every instance: yet I have cultivated it ever since 1794, on a barren soil with perfect success.

In the cultivation of grasses the farmer may have two distinct objects in view;

1. To produce herbage of a short duration, in a rotation of crops.
2. To produce permanent pasture.

In regard to the first of these, viz. the production of hay crops for two or three years, it is not my present intention to treat very particularly on that subject; but on some future occasion I may be induced to offer my opinions on that head more fully. In the sequel I shall only suggest some remarks regarding the cultivation of hay crops on poor soils. I may here notice in passing, that no grass which is merely annual can much deserve the attention of the British farmer; and I have lately seen some seeds of panic grass which had been presented to the Highland Society, as the grass cultivated in Hungary for a hay crop; but as this falls under the description of an annual, little is to be expected from it.

The second head above mentioned, viz. to obtain permanent pasture, shall be the chief subject of the present paper. Many words are not necessary to prove, that it would be a most desirable object with every possessor of high lands, or sterile grounds of every description, to have a method pointed out to him by which these lands might be rendered productive. Projectors and visionary writers have broached many schemes, which every skilful farmer would reject without trial; and even those who have done most to effect this desirable purpose, have fallen into strange and unaccountable errors, by the want of truly discriminating the species and nature of the plants which are the subjects of their investiga-

[1] Mr. Knapp in his elegant work on British grasses has admitted my *A. uliginosa* as a distinct species, but he has chosen to change the specific name to *A. scabro-setacea.*

[2] Zig-zag meadow grass.

tion. For example, in the excellent work of Mr. Stillingfleet, we read "That the heath hair grass (*Agrostis capillaris*) is certainly "one of the best, since it is common in pastures where sheep are "very prosperous." Now the *Agrostis capillaris* is not a native; the *A. vulgaris* must therefore be meant. On this supposition also, he is under a great mistake; for that *Agrostis* is known to be one of the worst of grasses. The abundance of its flowering stems is a proof that it is rejected or disliked by the cattle. I have always observed this grass to take hold of barren ground, where tillage had been tried, and after a bad crop or two abandoned. On such sterile land a stranger is often astonished at the apparent luxuriance of this useless grass, in the autumnal season: But every experienced farmer knows that it is the worst of pasture, or rather no pasture at all. How much then must it interest the cultivator of such a soil, to discover a grass that might thrive as well as this, and at the same time afford nutritious food for his cattle?

Having shewn the great utility of this improvement in agriculture, as well as the possibility of making the trial in a satisfactory manner, I shall proceed in the next section to mention the grasses that appear to me preferable to others for the end proposed.

Sect. II.

ENUMERATION OF THE GRASSES AND PLANTS RECOMMENDED TO NOTICE FOR THE IMPROVEMENT OF BARREN SOILS; WITH SOME ACCOUNT OF THEIR NATURE AND PROBABLE USE IN CERTAIN SITUATIONS.

1. *Poa nemoralis*[1]. This grass seems to have been entirely overlooked by agricultural writers on British grasses. Both Dr. *Withering* and Dr. *Hull* regard it as an annual, but Dr. Smith, in his *Flora Britannica*, has marked it as perennial—which it certainly is. It is found native in woods and shady places. I have cultivated it for upwards of ten years past in different soils and situations, with complete success. I first planted it on a good soil, when it produced abundantly. I afterwards had occasion to remove my collection of living plants to a piece of ground near the town of Forfar. I then planted it on a dry sloping bank of sand, which formed the back of a mud wall raised as a fence. In this poor soil, this dry and exposed situation, it produced a crop little inferior to what it yielded when cultivated in the rich soil. In this sandy soil it has remained for these seven years past, annually affording a

[1] Wood meadow grass.

good crop. When I last visited my botanical arrangement at Forfar, I found that it had produced a thick crop from a foot to sixteen inches high. I must here observe, that in the second and third years the crop will be more abundant than in the first year after sowing; and then it will continue to produce for many years plentifully. An analogy between plants and animals may here be traced. It is observed, that the longer time an animal requires to arrive at maturity, the longer it remains in a perfect state; so, although the *Poa nemoralis* does not arrive at maturity the first year, yet it would amply repay the farmer for his trouble, as it would continue to produce abundant crops for a number of years in succession. But even the first year after sowing, this grass will in general produce a tolerable crop. Were I to compare this grass with the common rye grass, I should certainly give it the preference. The *Lolium perenne* arrives quickly at maturity, and fails proportionally sooner. Horses, cows, and sheep are equally fond of the *Poa nemoralis*; and I should not be surprised to see it, after trial, more cultivated than the rye grass as a hay crop; at least in some situations. One great superiority which it possesses over the *Lolium*, is the number of leaves it produces. It has generally *six* or *seven*, whereas rye grass has only *three*. I have carefully examined a number of rye grass plants in various soils and situations, and *three* was the number of leaves I constantly found. From this it appears, that there are double the number of leaves produced on the *Poa nemoralis* which are produced on the *Lolium perenne*; and this alone, in my opinion, is a great recommendation: But this *Poa* also frequently branches in the stem, an advantage seldom met with in other grasses. It produces its seeds abundantly. It flowers in June, and ripens its seeds in July.

2. *Poa glauca*[1]. This grass has never attracted the notice of any writer on agriculture. I first found it among the rocks on Ben Lawers, and in other high mountains of Breadalbane, in 1784. It has received the trivial name of *glauca*, from the blueish colour of its leaves and stalks. This grass I have cultivated at Forfar since the year 1793. I have found it to thrive well on the most barren soil. Indeed I am convinced there is no soil, however sterile, which would not produce this grass. It is easily cultivated, and forms a good stool for late pasture. Horses, cows, and sheep are fond of it. It is little inferior to *Poa nemoralis*, though no quite so tall. It affords more radical leaves, and is therefore preferable for pasture. It also flowers in June, and ripens its seeds in July.

[1] Glaucous meadow grass.

3. *Poa alpina*[1]. This grass is also new to the agriculturalist. I first found it in 1788, on a high rock called Corbie Craig, in the parish of Tannadice, and among stones near Airly castle in Angusshire. It is also found near the summit of several of the Highland Alps; but in these very elevated situations it is always viviparous: that is, its flowers become perfect minute plants, which drop off and strike root in the ground; an admirable provision of nature for the propagation of the plant in such alpine regions, where the severity and continual moistness of the climate would in general prevent the seeds from ripening. Even in the most lofty and barren situations this plant would make excellent pasture; and I am certain that many soils and situations which could never be turned to account otherwise, might be rendered valuable as pasture by the introduction of this grass. It forms a good foggage, and even continues to grow through the winter. In short, the *Poa alpina* is one of the best grasses for establishing a green sod for pasture on upland grounds, where few good grasses would vegetate. It is true, that a hay crop could not be expected from it; but would it not amply repay the expence of labour, by converting sterile heaths into profitable sheep-walks, and green fields for cattle? The enterprising and ingenious farmer might thus be enabled to improve immense tracts, at present not worth a shilling each acre annually, but which might in many cases become of fifty times that value.

4. *Poa compressa*[2]. Mr. *Sowerby*, in his English Botany, No. 365, justly remarks, that this grass will not succeed in moist or manured ground; but in very stony places it might be cultivated, and form a green surface where few other grasses would grow. I would not have it introduced into fields where crops of corn were raised in rotation, for the same reason that, in such a case, I would reject the *Poa pratensis*, viz. because it would be almost impossible ever to eradicate it from the ground. Nor would I adopt the *Poa annua*[3] as a cultivated grass, though for a different reason, viz. the difficulty of collecting its seeds. Were we to plant it, as mentioned by Dr. *Martyn*, it would certainly be an excellent grass for pastures that are much trodden.

5. *Poa pratensis.*[4] This grass is generally allowed to make good hay and pasture; but its running roots, as above hinted, render it not eligible when corn is to be cultivated. Its merit lies in intro-

[1] Alpine meadow grass.
[2] Flat stalked meadow grass.
[3] Annual meadow grass.
[4] Smooth stalked meadow grass.

ducing a permanent pasture. It spreads rapidly, and produces abundance of radical leaves; and in sterile fields it ensures a lasting sward of good grass. It will thrive on peat bogs. Its seeds remain long on the panicle, and are easily collected.

6. *Poa trivialis*[1]. This *Poa* is also deservedly praised by all the writers on the grasses. It succeeds beyond any grass in moist and rich soils. It constitutes almost the whole herbage on the meadow under the castle of Edinburgh, and also of the meadow under the north east end of Salisbury Craigs, in both which places it is cut six or eight times every season. It is however to be regretted that the seeds of this grass are fugacious, and cannot be collected, unless cut before they are quite ripe. In boggy soils, it might be worth the trouble to *plant* tufts at the distance of five or six feet, which in a few years would infallibly cover the whole surface with this best of grasses.

7. *Festuca rubra*[2] of *Flora Britannica*. This grass is one of those valuable plants, which like the *Arundo arenaria*, tends to arrest the progress of the sand on the sea shore, and often prevents it from overwhelming great tracts of the neighbouring soil. On observing this grass in its native situation, I am satisfied that it is one of the best for pasture, as it produces a considerable number of succulent radical leaves of uncommon length. This plant has not been noticed by agricultural writers. It cannot be the grass spoken of in Anderson's Essays, under the name of Purple fescue. His grass is said to be common in fields, and must of course, be *Festuca duriuscula*.

8. *Festuca duriuscula*[3]. This is deservedly considered by Mr. *Swayne*, Dr. *Withering*, Dr. *Martyn*, Mr. *Curtis*, &c. as a valuable grass, springing early, and acceptable to all kinds of cattle. As it forms a very close turf, it may often be preferable to the *F. rubra*, even on the sandy shores. In looking over old pastures, I have always observed this grass closely cropped by the cattle, and scarce a flowering sprig to be seen. It has also the advantage of thriving in a poor soil, and even under trees. It flowers in June, and ripens in July. Its seeds are easily gathered, as they remain till ripe on the spike.

9. *Festuca pratensis*[4], is a plant justly esteemed by Mr. *Curtis*, and other writers on the *Gramina*. It is found on the wettest meadows and bogs. If care were taken to sow this grass in such

[1] Rough stalked meadow grass.
[2] Creeping fescue grass.
[3] Hard fescue grass.
[4] Meadow fescue grass.

situations, it would produce an excellent hay crop, and also afford good pasture. I have cultivated it for several years, and find it to answer almost in every soil. I have planted it in peat soil, and found it to succeed astonishingly. It flowers in June, and seeds in July. Cows, horses, and sheep are all fond of it.

10. *Alopecurus pratensis*[1]. This grass has been highly and justly extolled by every author who treats of the British grasses; and so far as I have observed, I consider it as one of the best, particularly for an early hay crop, on any tolerable soil, if not in a very high situation; and it is peculiarly well fitted for drained meadows. When I was in London, about the year 1786, I saw a patch of about twenty square yards of this grass, cultivated by Mr. *Curtis*, who on the same ground had patches of almost all the British grasses; but in my opinion, this *Alopecurus* exceeded them all, in quantity and quality as a hay crop. And it is an early grass; it flowers in May, and ripens in June. Its seeds adhere long to the spike, and are easily collected.

11. *Holcus lanatus*[2]. This grass has also the name of *Yorkshire fog* in some places of Scotland, probably owing to the thick tuft of leaves which it produces at the root. The late Rev. Dr. Walker, and other good judges, have greatly extolled this Holcus. It, no doubt, is very early, and prospers in any moist situation, however poor the soil. It also produces abundance of leaves, and even a full crop of hay; yet Dr. *Martyn* remarks, in *Flora Rustica*, that it is not much esteemed as a cultivated grass. For my own part, I regard it as inferior to many others. To make tolerable hay for feeding, it should be cut as soon as the spikes are formed. In that case, two crops may easily be had in the season. It has also this advantage, that when sown on meadows recently improved, its bundled roots might exclude the growth of *carices*. Its seeds are easily gathered.

12. *Anthoxanthum odoratum*[3]. This grass has been praised by Mr. *Curtis* for its early appearance, and readiness to grow in any soil or situation. This I can confirm from my own observation. I have seen this grass growing from the richest meadow, to the summit of our loftiest mountains. It produces a great number of radical leaves, and continues growing throughout the whole season. It communicates a pleasing odour to hay, or to any thing with which in has been in contact. Its seeds are easily collected.

[1] Meadow fox-tail grass.
[2] Soft meadow grass.
[3] Sweet scented vernal grass.

13. *Sesleria cærulea*[1] *(Cynosurus cæruleus, L.)* is the earliest of the British grasses, producing its flowers about the end of March, and ripening in May. Dr. Martyn saw it pushing out spikes on 16th March, 1792, and recommends it for culture. It is a native of Ben Lawers and other Highland mountains. I received specimens from York-shire, which were gathered in an upland wood. Of all the grasses which I know, this seems the most eligible for early pasture. I have cultivated it for ten years past in sterile dry sandy soil, likewise in good soil, and under trees, and it seemed little changed by soil or situation. In all it produced well. It is furnished with a vast number of radical leaves, which form close *stools* of a large size. It is capable of resisting the severity of the winter, and on that account I have long considered it as one of the most valuable of the British grasses. When the season advances, the leaves become strong, and feel harsh to the touch; but I found, on making the experiment, that cows, though fed in the house, preferred these seemingly coarse leaves to all other food that was offered them. In short, I am confident that no other grass better deserves attention; for its early growth, and the thick pasturage it affords, I certainly hold it unrivalled.

14. *Vicia cracca*[2]. This vetch has been recommended by Dr. Plot, and also in Anderson's essays. It grows frequently in stony places, in meadows, and very commonly in hedges, where it often rises to a great height. Cattle are very fond of it. It may be, in some cases, an advantage, and in others an objection, that it takes so deep and so strong a hold of the soil, that it is almost impossible to eradicate it. It might produce a very profitable crop among stones; and on bare spots where scarce any thing else would vegetate.

15. *Medicago sativa*[3]. This plant which is now naturalized in Britain, certainly produces a very superior kind of pasture on sandy downs. Though writers on this subject have not adverted much to this circumstance, I have long considered the chief merit of this plant to be, that it sends forth a number of long and strong roots, which penetrate deep into the sand, and which enables it to resist the longest droughts. I have seen plants of it flourishing in the arid sand, when all the surrounding vegetables were completely scorched. There is still another property for which it is valuable: in such a soil, the longer it remains in the ground, the better is the crop; so that an acre of twelve or fourteen years standing, would

[1] Blue moor grass.
[2] Tufted Vetch.
[3] Lucerne.

be worth three or four acres of the first and second year. I have further observed, that the plant is no where so long lived as in the sandy downs.—Very particular care should be taken in the choice of the seeds of this plant, as the old seeds will not vegetate.

I would not have it to be understood, that the *fifteen* plants enumerated above, are all the indigenous vegetables which I could recommend for trial by cultivation. Being unwilling to exceed the limits prescribed by the Honourable Society, I have confined myself to such as I thought preferable to others which have come under my observation. A full discussion of the British grasses, and of their various and comparative merits, would require a volume.

Sect. III.

ON THE PURPOSES TO WHICH THE PLANTS BEFORE RECOMMENDED MAY BE APPLIED; AND THE PROPORTIONS OF PARTICULAR SEEDS TO BE USED IN VARIOUS SOILS.

1. For dry gravelly soils.

In almost every upland farm, there are many acres under tillage that produce a scanty and unprofitable crop; and to which manure cannot be easily or conveniently applied. In such case, if the soil be dry and gravelly, and there is no prospect of soon restoring the field to a state of tillage, the following proportions of seeds will, in my opinion, ensure a permanent pasture.

Festuca duriuscula, Hard fescue grass,	one half,
Poa pratensis, Smooth stalked meadow grass,	one fourth,
Poa compressa, Flat stalked meadow grass,	one fourth.

In estimating the quantity to be sown, the cultivator may reckon upon one third less seed than he would take of rye grass, as the *Poas* form large plants.

If it be intended to render the field arable again in a year or two, as the *Poa pratensis* and *compressa* have running roots, and are therefore eradicated with difficulty, we may substitute

Poa nemoralis, Wood meadow grass,	one half,
Poa glauca, Blue meadow grass,	one fourth,
Poa alpina, Alpine meadow grass,	one fourth.

This will secure herbage in the most elevated situations; but if the soil be tolerable, and a crop of hay expected, the *Poa nemoralis* may be used alone.

2. For wet boggy soils.

When drainage is not eligible from the nature and situation of the ground, much might be done for marshy grounds if arable during summer. Where a permanent pasture is the only object, and the soil of bad quality, the *Holcus lanatus*, Meadow soft grass, alone appears preferable to all other grasses.

Where the soil and situation are tolerably good, the *Poa trivialis* should alone be used. This grass may be cut, perhaps five or six times during the summer, and will be found more profitable by this management, than if it were reserved for a hay crop.

If it be intended to convert boggy soil into arable land, draining is indispensable, and for a rotation of hay crops, take the following seeds.

Festuca pratensis, Meadow fescue grass,	two thirds,
Poa trivalis, Rough stalked meadow grass,	one third.

This mixture will always produce a good hay crop in tolerable soil. But in case of a superior quality of soil, I would prefer a taller kind of Fescue, called *Festuca elatior*, which some writers have regarded as a variety of the above, and others as a distinct species. It much resembles the above, the chief difference being that it is twice the size. In point of quality, this grass equals the rye grass, and as a hay crop, it should produce double the quantity.

What I have said above in regard to wet bogs, may be equally applicable to peat soil. For I have cultivated the grasses now enumerated, in peat soil, with success.

3. For sandy downs on the shore.

In cultivating loose sand, the great object frequently is, to introduce such plants as are likely to bind the soil, and form a sward of pasture acceptable to cattle. In this case the following seeds may be used,

Festuca rubra, Creeping fescue grass,	one half,
Festuca duriuscula, Hard fescue grass,	equal parts
Poa pratensis, Smooth stalked meadow grass,	for the
Poa compressa, Flat stalked meadow grass,	other half.

If the soil be pure sand, a hay crop need not be expected; but a permanent pasture may be thus established.

In case the sand be dry, and apt to become parched, nothing can equal the Lucerne as a profitable crop, either for cutting or pasture.

If equal parts of Lucerne and *Festuca rubra* were sown in such a soil, it might ensure a tolerable pasture through the whole season.

4. For early pasture.

No husbandman should neglect to lay out some part of his ground for early pasture, the want of which is so often the subject of complaint among farmers in this country.

In a poor soil, with no immediate prospect of subjecting the land to tillage, for a rotation of crops, equal parts of

Sesleria cærulea, Blue hair grass, and
Anthoxanthum odoratum, Sweet scented vernal grass, will insure a permanent pasture.

If the situation be much elevated, a portion of the *Poa alpina* may be taken with the *Anthoxanthum*.

If the soil be good, and not too high, take

Alopecurus pratensis, two parts.
Anthoxanthum odoratum, one part.

This would afford an early and excellent pasture, or a hay crop, if more desireable.

Sect. IV.

ON PROCURING THE SEEDS OF THE GRASSES.

The greater part of writers on the *Gramina*, have contented themselves with recommending certain plants as fit for the purposes of agriculture: But it should be remembered that the cultivators of land are, for the most part, very ill qualified to discriminate the species of the grasses; much less can they spare time to go in search of them. It is not then to be wondered at, that so few attempts have been made to cultivate the various indigenous grasses. Yet it is certain, that at present, when such a spirit of inquiry is awake, many gentlemen, and others eager for improvement, would gladly take the trouble of making trials, more or less in this way, if the means of doing so were at hand. Were this kind of culture once set on foot, we might reasonably hope to see much of our sterile and waste land (unfit for other crops) converted into profitable pasture.

The vast importance of opening this new track to the view of the improver of land, must be sufficiently obvious. The grand obstacle that stands in his way, is the difficulty of obtaining the seeds of the

grasses, especially of the rarer kinds. To remedy this, I would gladly exert my utmost endeavours to cultivate a moderate quantity of seeds annually; and I might also institute a variety of experiments on grasses and other plants for feeding cattle; which I flatter myself, would contribute to the advancement of that branch of agriculture in this country:—and this I would be the better enabled to do, were I to execute my plan under the auspices, and with the pecuniary support, of the honourable Society to whom this paper is addressed, so distinguished for their patriotic and well-directed exertions.

APPENDIX.

ON SOME INDIGENOUS PLANTS AND GRASSES *not* ELIGIBLE FOR CULTIVATION.

After perusing the foregoing paper, it may be alleged that I have omitted to mention several plants and grasses, which from their size and appearance, seem eminently adapted for cultivation. To obviate such remarks is my present intention; the more especially as it appears as necessary to inform the cultivator what plants he should avoid, as to point out to him those which he should select.

In my humble apprehension, there are two requisites indispensably necessary to every indigenous plant to be tried in cultivation.

1. It must be acceptable to cattle:
2. It must produce a tolerably abundant crop.

There are few persons who would blame me for rejecting those plants on which cattle do not feed; yet many theoretical writers have proposed plants for cultivation, against which this objection may be fairly urged.

To begin with the *gramina*.—In the genus *Aira*, (with the exception of the *A. aquatica*[1], which seems the connecting link between the *Poa* and *Aira*) there are almost none that can be reckoned valuable. The *A. caryophyllea*[2], *precox*[3], and *canescens*[4], are all diminutive grasses; the *flexuosa*[5] is not equal to the *Festuca ovina*. The *A. cespitosa*[6] is indeed the largest grass that appears as a native of

[1] Water Hair grass.
[2] Silver Hair grass.
[3] Early Hair grass.
[4] Gray Hair grass.
[5] Waved Mountain Hair grass.
[6] Turfy Hair grass.

barren soils; but it certainly is the worst of all the British *gramina*. Other coarse grasses have sometimes their young and radical leaves sufficiently tender and grateful to cattle, but this grass in all its stages, seems equally disliked.—I know not if starvation would force cattle to brouze on it.—I have observed it on the Highland mountains for many years, where cattle are compelled to feed on the coarsest grasses, yet I have never seen a single plant of it cropped by any animal. This grass may be known from all others, by the large tufts it forms, elevated above the level of the pasture, which is occasioned by the accumulation of leaves, from one year to another. In regard to this grass, the question with the farmer, is not how it can be cultivated, but how it can be eradicated.

Among the grasses in the tribe of Bromes, although very frequent among hay, there are few which I can venture to recommend. They intrude themselves every where among cultivated grasses; and although chiefly annual, they shed their seeds so abundantly, that a small number of plants, scattered in a field, soon diffuses the bromes over the whole, to the exclusion of other grasses. The *Bromus erectus*[1] is the only species that has a chance to be useful.

Some gentlemen of considerable observation and experience have thought that the *Agrostis vulgaris*[2] was an eligible plant for cultivation, and that it makes good hay: But to this, I am persuaded, no practical farmer would agree; for in every neglected field in hilly ground, (as for instance, on the top of Braid's hill near Edinburgh) this *Agrostis* may be seen often a foot high or more, matting the surface, so that one ignorant of grasses might mistake it for a hay crop; yet this math remains untouched by the cattle, though these fields be pastured throughout the whole season.

The *Agrostis stolonifera*[3] has been mentioned as the far celebrated Orchestan grass. But this I am fully convinced is a mistake; for I have been assured by an eminent botanist, who visited the place within these few years, that the greater part of the grass on these meadows, was no other than the *Poa trivialis*, a grass which I have already mentioned as constituting the chief herbage in the meadow under Salisbury Craigs, and in other rich meadows round Edinburgh. There is indeed no species of *Agrostis* that cattle are fond of; and as they are generally avoided in pastures, we have no

[1] Upright Brome grass.
[2] Fine bent grass.
[3] Creeping bent grass.

reason to believe that any of them would answer as hay. Besides, there is no grass, not even the *Triticum repens*[1], so difficult to eradicate. The only other to be compared with it, is the *Holcus mollis*—a grass which can only be useful, when cultivated on sandy downs, with a view to bind the sand by its running roots.

Among the *scirpi*[2], the *schœni*[3], and the *junci*[4], none so far as I know, have been thought of as fit for cultivation. Many of the *scirpi* and *schœni* are diminutive, and all of them exceedingly harsh. In regard to the *junci*, I have never seen them applied to any agricultural purpose, except the making of ropes. For this purpose the *Juncus effusus*[5], when peeled, was in some parts of Scotland, much used half a century ago. The *Juncus articulatus*[6] was also made into cushions, to be put under the yoke used by oxen; for which purpose, from its toughness, it seems well adapted. I have often observed this *Juncus* in the most unfavourable situations in the Highlands, where cattle were often straitened for food; but it generally remained untouched. The same observation may be made by any person who will take the trouble to view this plant, on the Pentland hills, near Edinburgh[7]. Not one of the rushes indeed, claims the attention of the farmer, unless it be for the above purpose, or for litter or thatch. Were it even possible to use the *Juncus articulatus* as a grass crop, the extreme difficulty of eradicating it, would be a sufficient objection. I remember, fifteen years ago, to have seen eight oxen and four horses yoked in a plough, on the high grounds in Forfarshire, to tear up a meadow covered with this strong rooted plant; but their efforts were inadequate to accomplish the business completely; for when they had finished the operation, more than a third part remained green, and apparently not turned over.

In regard to plants which are not properly grasses, few have been more loudly recommended by some persons than the *Plantago lanceolata* or rib grass; but in my opinion with no good reason; Mr. Dickenson, a gentleman well known for his attention and accuracy, and whose opinion should be decisive, expressly says, that he has seen twelve acres of rib grass cultivated, but that no

[1] Couch grass, or Creeping Wheat grass.
[2] Bull-Rushes, or Club-Rushes.
[3] Bog-Rushes.
[4] Rushes.
[5] Soft Rushes.
[6] Sprat or jointed Rush.
[7] In the hay from some wet meadow grounds, this species may sometimes be found composing a part of the herbage; but in proportion as it abounds, it renders the forage of little value; and if there be on any spot, a great quantity of it, it is either not mown at all, or excluded out of the general mixture.

animal would eat it. To this account I can give full credit, as I have carefully observed for two years back, that this plant is left untouched by the cattle grazing in the parks adjoining to the Botanic Garden; nor do I think they ever eat it, unless when mixed with other herbage. The habit of growth in this plant is another objection to its culture. Its radical leaves spread like the rays of a circle from the centre, and destroy the herbage around it. Some writers have mentioned the *Bellis perennis*, or common daisy, as a valuable plant in pastures; but the abundance of its beautiful flowers seen in every meadow, demonstrates that it is rejected by cattle, and that as a celebrated agriculturist observes, "it owes its beauty to its worthlessness." Such fancies remind me of the idle notion entertained by some women and children in the country, that the summer butter takes its yellow colour from the flowers of the crow-foot which they call butter-cups!

I cannot conclude without expressing my regret, that speculative farmers in general, and especially those who undertake to write on agricultural subjects, are often altogether unacquainted with Botany, and, of course, have an imperfect knowledge of most of the plants of which they wish to treat. Hence the trials made from their suggestions too often end in disappointment and disgust, and thus throw a bar in the way of improvement; whereas judicious and well conducted experiments guide us in the right path to advancement in agriculture, as well as in every other science.

APPENDIX F.

ACCOUNT of the Native Plants in the County of Forfar, and the Animals to be found there.[1]

By Mr. DON of Forfar.

Alpine District of Angusshire.

The lofty mountains which surround the upper part of Clova, present to the Botanist an interesting field for rarities :—not even Ben-Nevis, Ben-Lawers and Ben-Lomond, and the high mountains of Cairngorm, taken altogether, can furnish such botanical treasures as are to be met with on the mountains of Clova.

On the summit of these mountains, the following plants are to be met with.—Those to which an asterisk * is prefixed, are new to Britain, and almost all of them peculiar in this country to the Clova Mountains.

Cornus Suecica
Ophrys cordata
Leontodon palustre
Sibbaldia procumbens
Saxifraga stellaris
,, aizoides
,, rivularis
,, oppositifolia
* ,, pedatifida
* ,, elongella
* ,, platypetala
* ,, *nova species*
* ,, *nova species*, which I believe to be the S. muscoides of Willdenow
*Myosotis repens
Alchemilla alpina
Juncus trifidus
,, triglumis
,, supinus
,, spicatus
* ,, gracilis
Cochlearia officinalis, var. γ, the Cochlearia Grœnlandica of our British authors, but not of Linnæus
Epilobium alpinum
,, alsinifolium
Rumex digynus
Spergula saginoides
Hieracium denticulatum
,, alpinum

[1] Reprinted from "General View of the Agriculture of the County of Angus, or Forfarshire," Appendix B. By the Rev. James Headrick, Edinburgh, 1813.

NOTES

FROM THE

ROYAL BOTANIC GARDEN,

EDINBURGH.

FEBRUARY 1905.

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Aspidium Oreopteris
*Ranunculus alpestris; but rare
Azalia procumbens
Gnaphalium supinum; and a variety
„ sylvaticum; but rare
Betula nana
Veronica alpina
„ humifusa
*Eriophorum gracile
Arbutus Uva ursi
Pyrola rotundifolia
„ uniflora; but rare
Thalictrum alpinum
Tofieldia palustris
Hedypnois taraxaci
Salix herbacea
Vaccinium uliginosum
„ Vitis-Idæa
Trientalis europæa
Rubus Chamæmorus
Silene acaulis
Cerastium alpinum
„ latifolium
* „ nivale, *nova species*
Malaxis paludosa
Lycopodium annotinum

On mountains to the eastward of Clova, I discovered the beautiful Potentilla tridentata, new to our British Flora.

On the rocks among the Clova mountains, are to be found the following interesting plants:

Pteris crispa
Aspidium Lonchitis
Epilobium angustifolium
Ilex Aquifolium
Sonchus cœruleus of Fl. Brit.; truly a rare plant. The Sonchus Canadensis of Linnæus, although given by Dr. Smith as a synonym, is a very different plant. S. cœruleus is now lost at Howden Pans, in England; and at present we know of no other habitat for it but the Clova mountains, and their vicinity
Draba incana; and likewise var. *β*
Poa flexuosa
„ glauca
Melica nutans
Pyrola secunda
Potentilla aurea
*Salix rupestris
„ prunifolia
„ Andersoniana
Salix arenaria
„ incubacea
„ glauca
*Hieracium divaricatum
„ cerinthoides
* „ amplexicaule; besides several non-descript species
*Tussilago alpina
*Cochlearia grœnlandica of Linn.
* „ alpina, *nov. sp.*
*Lychnis alpina
*Potentilla opaca
*Arenaria fasciculata of Jacquin; the fastigiata of English Botany
Serratula alpina
*Carex laxa of Whalenberg
„ atrata
„ pallescens; and several non-descripts of that genus
Cyathea dentata

On the upland pastures grow the Satyrium albidum and Satyrium viride.

Among the rarer Mosses to be found among these mountains, may be mentioned the following:

Hypnum pulchellum
" denticulatum
" undulatum
" alpinum
" plumosum
" myosuroides
" implexum
" molle
" Schreberi
" rufescens
" fluitans
" stellatum
" rugosum
" revolvens; and some non-descripts of this genus
Bartramia gracilis
" arcuata
" Merchiana
" Halleriana
" crispa
" ithyphylla
Tortula brevifolia
" tortuosa
Trichostomum fontinaloides; and var. β
" lineare
" glaucescens
" microcarpon
" rigidulum
" capillaceum
" trifarium
" ericoides
Grimmia cirrata
" striata
" conostoma
" nigrita
" Schisti
" Donniana
" heteromalla
" recurvata
" acuta
" rivularis

Polytrichum hercynicum
" strictum
" alpinum
" attenuatum
Bryum compactum
" bimum
" crudum
" Zierii
Bryum julaceum
" alpinum
" trichodes
" dealbatum
" elongatum
Neckera curtipendula
" crispa
" pumila
Gymnostomum microstomum
" lapponicum
" fasciculare
" stelligerum
" curvirostrum
Buxbaumia foliosa
Splachnum rugosum
" gracile
" tenue
" angustatum
" mnioides
" fastigiatum
" ovatum
Dicranum fuscescens
" flagellare
" uncinatum
" falcatum
" fulvellum
" rufescens
" ovale
" patens
" montanum, rare
" squarrosum
" flexuosum
" polyphyllum
" strumiferum
" virens

Dicranum crispum
„ osmundioides
* „ pygmæum
Jungermannia bifida
„ ciliaris
„ divaricata
„ setiformis
„ emarginata
Jungermannia reptans
„ adunca
„ julacea
„ cochleari-formis
„ trilobata
„ curvifolia
„ resupinata

Besides many others of the foliaceous mosses.

The species of the genus Lichen are, as might be expected, very numerous in these mountains. This extensive Linnæan genus has lately undergone a change in arrangement, and a subdivision into several genera, by the eminent Dr. Acharius. In mentioning the most remarkable, I shall adopt the new nomenclature.

Lecidea Muscorum
„ petræa
„ miscella
„ rivulosa
„ confluens
* „ fumosa
* „ fusco-ater
„ dendritica
„ atro-alba
„ silacea
„ Œderi
„ niveo-ater
„ pruinosa
„ cupularis
„ Dicksonii
„ tricolor
„ icmadophila
„ luteola
* „ atrata
„ granulosa
„ cinereo-fusca
„ calva
„ cæsio-rufa
„ orosthea
„ polytropa
„ atro-rufa
„ lurida
„ canescens
„ vesicularis
„ pustulata
Gyrophora glabra
„ erosa
„ proboscidea
Gyrophora cylindrica
„ pellita
Verrucaria nitida
„ stigmatella
„ epidermidis
„ umbrina
Endocarpon smaragdulum
„ miniatum
„ complicatum
„ Weberi
Thelotrema hymenium
„ pertusum
Sphærophoron coralloides
„ compressum
Isidium corallinum
„ Westringii
Urceolaria calcaria
„ cinerea
„ fimbriata
„ Hoffmanni
„ scruposa
„ Acharii
„ cirtaspys
„ ostracadermis
* „ diamarta of Acharius
Parmelia ventosa
„ perella, var. 3. Upsaliensis
„ tartarea, var. 2. frigida
„ dispersa
„ cerina

Parmelia vitellina
" hypnorum
" brunnea
" candelaria
" gelida
" circinata
" epigea
" miniata
" cæsia
" recurva
" fahlunensis
" conspersa
" hæmatomma
" pulverulenta
" stygia
" affinis
" plumbea
" caperata
" herbacea
" glomulifera
" scrobiculata
" pulmonacea
" saturnina
" lacera
" nigrescens
Parmelia crispa
" fascicularis
" furfuracea
" jubata, var. 4. chalybeiformis
Sticta limbata
" sylvatica
Peltidea aphthosa
" resupinata
" crocea
" saccata
Cetraria nivalis
" islandica
Cornicularia aculeata
" tristis
" spadicea
" lanata
" pubescens
Stereocaulon paschale
Bæomyces roseus
" rupestris
" Papillaria
" bellidiflorus
" cenoteus
" spinosus

The plants, natives of the Clova mountains, which have the chief claim to the farmer's notice, are the Gramina. Of the rarer grasses, the first is the Alopecurus alpinus, a new species which I discovered many years ago. This grass I have cultivated for several seasons, and I am convinced it is but little inferior to the A. pratensis, so much taken notice of by agricultural writers. It has the advantage of the latter, in so far as it increases more freely in the roots, and readily produces perfect seeds, the want of which is sometimes complained of in the A. pratensis. The next is Phleum alpinum, which forms a considerable part of the pasture on the mountains of some of the northernmost parts of Europe, and seems a grass well calculated for pasture in alpine districts. Poa nemoralis, Poa glauca, and Poa alpina, and the variety vivipara, are all good grasses; the P. alpina is one of our best pasture grasses on poor soil, with a bad climate. Lately I discovered three other grasses, new to Britain, viz. the Avena plano-culmis of Schræder, Fl. Germanica, producing a great quantity of foliage; the Aira lævigata; and the Phleum Meichelii, the Phalaris alpina of the German authors: these grasses grow on the very summit of the highest mountains.

The pasture on the mountains, particularly on the summits, is composed of the following grasses:

Eriophorum vaginatum
„ angustifolium
Scirpus cæspitosus
„ pauciflorus
Melica cœrulea
Nardus stricta
Aira flexuosa
„ cæspitosa; together with var. vivipara
Agrostis vulgaris, several varieties
Festuca vivipara
„ ovina
„ duriuscula; and also var. dumetorum
„ cæsia
Poa humilis
„ decumbens
Carex binervis
„ rigida
„ fulva
„ Oederi
Carex dioica
„ cæspitosa
„ recurva
„ ampullacea
„ Micheliana
„ limosa; but rare
„ panicea
„ pilulifera
„ præcox
„ flava
„ teretiuscula; but rare
„ curta
„ stellulata
„ pauciflora; but sparingly
„ pulicaris
Juncus trifidus
„ squarrosus
„ articulatus
„ uliginosus
„ spicatus
„ campestris

The pasture in the valleys in the high lands is the same as in the low lands, only with the addition of the Meum athamanticum.

Angusshire has some of the best grasses growing native by the sides of the rivers and rivulets: such as the Alopecurus pratensis, Festuca elatior, Festuca pratensis, Festuca triflora; the latter but rare. I have observed, although sparingly, the Festuca loliacea. I have of late discovered a non-descript species of Festuca, which seems to be equal, if not superior, to almost all the known species. We have also a number of the genus Poa, and some non-descript species of that genus. The poa furnishes some of the best grasses we are acquainted with, viz.:

Poa trivialis
„ glauca
„ alpina
Poa pratensis
„ nemoralis
„ humilis

The P. alpina and P. humilis form excellent pasture in alpine or barren districts.

As we descend from the high lands, the vegetables are, with few exceptions, the same as in the neighbouring counties: some, how-

ever, are rather of rare occurrence. In several of the woods are to be found the Ophrys cordata and ovata, Trientalis europæa, Hieracium molle, prenanthoides, sabaudum, and paludosum; and in the fir woods near Forfar grow the Hieracium paniculatum, var. maculatum, not yet found in any other part of Britain; together with the beautiful Trollius europæus, Pyrola minor and rotundifolia; and also Juncus Forsteri, Melica uniflora, Carex pallescens, remota, sylvatica, lævigata and pendula, Triticum caninum, and Festuca gigantea. Milium effusum likewise occurs: this grass, although never noticed by agricultural writers, promises to be useful, producing abundance of foliage, which is grateful to cattle. By the side of the Isla grow the beautiful Orobus sylvaticus; and Ribes petræum, which may prove equal, if not superior, to the R. rubrum: also Ribes Grossularia; Vicia sylvatica, one of the most beautiful of all the British plants; Lonicera periclymenum, var. quercifolium, and Viburnum Opulus, and Paris quadrifolia. Likewise the uncommon Allium carinatum; this is also found among the rocks; it is of rare occurrence in other parts of Britain. Besides these occur the Allium ursinum, Adoxa Moschatellina, Melampyrum sylvaticum and pratense, Chrysosplenium alternifolium, Lysimachia nemorum, Campanula latifolia, Satyrium repens, and Equisetum hyemale. This last is the plant brought from Holland for polishing wood, and sold to cabinet-makers under the name of *rushes*. There are, further, some rare cryptogamous plants, among which are the following: In the fir woods near Forfar, is the Dicranum undulatum and Hypnum crista-castrensis, not found any where else in Britain. And in the order Fungi, is Hydnum auriscalpium, repandum, sublamellosum and imbricatum, Helvella caryophyllæa, Agaricus cinnamomeus, elephantinus, and deliciosus; together with the very poisonous one called by Linnæus A. muscarius, and its var. verrucosus, with many others. As cattle sometimes eat these, it is possible that they may bring on disease. The singular fungus called Phallus impudicus, occasionally appears. Helvella spathulata and Clavaria militaris are to be found in General Hunter's woods at Burnside, besides a great many others. I may also add the Boletus perennis, versicolor, abietinus, suberosus, and igniarius: the latter is called *touchwood*, being used for tinder. Also the Riccia fruticulosa, with Jungermannia scalaris, albicans, ovata trichomanes, and excisa.

When the botanist traverses the marshes, and examines the lakes, he will find his trouble amply repaid. In the lakes of

Forfar, Rescobie, and Balgavies, he will meet with the Typha latifolia; this is also in a rivulet not far from Pitmues, by the side of the turnpike-road that leads from Forfar to Arbroath. In the lakes of Rescobie and Balgavies, are likewise to be found Nymphæa lutea and alba, and Ceratophyllum demersum; and on their margins Lysimachia thyrsiflora: the latter plant, though rare in other parts of Britain, is not uncommon in Angusshire. Potamogeton perfoliatum, lucens, crispum, pectinatum, compressum, gramineum, pusillum, likewise occur in these lakes. Cicuta virosa, which is one of the most virulent of all the vegetable poisons, grows on their margins. Cattle, when allowed to browse by the sides of the lakes in the winter months, are sometimes deceived, by its smell being very weak at that season; and when once they have eaten it, it generally proves fatal in two or three hours. The late Mr. Dickson of Cloak's-bridge lost three cows in one afternoon by this plant. When the summer is a little advanced, the odour of the plant warns the cattle, and then they carefully avoid it. The Scirpus lacustris, the well known rush, so much used for making rush-bottomed chairs, is common; and in the lake called Loch Feithie, is to be found the Isoetes lacustris, generally supposed only to be found in alpine lakes. In the lake at Forfar is the Stratiotes aloides, which I brought from a great distance, and introduced there about the year 1792: it is now (1811) in great abundance. Lemna trisulca is frequent. Hippuris vulgaris is also very common; the latter being somewhat interesting to the botanist, as it belongs to the Monandria, or first class of the Linnean system, there being only four other plants indigenous to Britain that belong to that class. At the east end of the Lake of Forfar, in small pools, is to be found the Utricularia vulgaris and minor, both beautiful plants, and rather of rare occurrence: likewise Sparganium natans and simplex, Veronica anagallis, Chara hispida and var. β, and Ranunculus Lingua.

In the lake called the Loch of Lintrathen, the beautiful Lobelia Dortmanna is in abundance; and the rare Potamogeton lanceolatum, only of late known to be indigenous to Britain.

In the marshes are to be found the Scirpus pauciflorus, acicularis, sylvaticus, and fluitans; with the beautiful Parnassia palustris, so much taken notice of by botanists, on account of its singular nectary, which is figured in every elementary book. The following also occur:

Poa aquatica; but not common
Carex stricta
" paludosa
" Micheliana
" Oederi
" limosa
" paniculata
" teretiuscula
" intermedia
" curta
Scutellaria galericulata
Eriophorum vaginatum
Pilularia globulifera
Hydrocotyle vulgare
" inundata
Galium Witheringii
" uliginosum
Littorella lacustris
Centunculus minimus occurs, but is rare
Radiola millegrana
Viola palustris
Drosera rotundifolia
Alisma ranunculoides
Peplis portula
Vaccinium oxycoccus, or cranberry, the fruit of which is brought in quantity from the north of Europe, and used for making tarts

In the Moss of Restennet formerly grew the Schœnus mariscus, the only place I have seen it in Angusshire; but it is now entirely lost there. The Chara hispida grows in pools in the same moss; and there I discovered, in 1791, that truly rare and beautiful grass, the Eriophorum alpinum, the first and only time it has been found in Great Britain. I am sorry, therefore, to say, it has been extinct there for these several years past, and that at present we know of no British habitat for it: it is found on the mountainous heaths of Germany, Denmark, Sweden and Norway.

In the marsh called the White Mire, near Forfar, I discovered in 1807 the Arundo stricta of Schræder's F. Germ., and the Arundo neglecta of Ehrart, being the only place where it has been found in Britain; but I am sorry to say it will be soon entirely lost, by the draining of the marsh. This reed produces a great quantity of foliage, and might prove a grass of considerable utility to the farmer in marshy grounds; it is much more promising in its appearance than the rest of the reed family. There is also the Eriophorum polystachion, the only place I have seen it in Angusshire; and the Carex filiformis and Galium Witheringii. In the ditches are the Potamogeton fluitans and heterophyllum, both only of late years known to be natives of Britain; and in the marshes grows also the Saxifraga aizoides.

Some rare mosses also occur, among which are the following:

Polytrichum aloides
" gracile
" attenuatum
" nanum
Bryum dealbatum
Bryum ventricosum
" turbinatum
" sericeum
" hornum
" bimum

Bryum compactum
Dicranum heteromallum
„ strictum
„ glaucum
„ pellucidum
„ adiantoides
„ flexuosum, var. fragile
„ osmundioides
Hypnum stellatum
„ revolvens
„ cuspidatum
„ cordifolium
Hypnum dendroides. This is every year to be found with fruit near Forfar, though the fruit is accounted rare
„ scorpioides
„ molluscum
„ commutatum
„ rugosum
Splachnum ampullaceum
„ ovatum
„ fastigiatum

In a marsh, near Colonel Kinloch's of Logie, I discovered in 1810 the Iris xiphioides, new to Britain: it was growing among Carices and Juncus effusus and articulatus, in a situation where it had never been cultivated.

In the Moss of Cassens is the Polytrichum strictum of the Banksian Herbarium, the same as Sir Joseph Banks had from Iceland: it is not the species described by British authors, which is probably no more than a variety of P. commune or juniperinum, as Dr. Smith informs me, who is in the possession of the Linnean Herbarium, and has access to the Banksian also.

The following is a list of the more remarkable plants to be found in the low parts of Angusshire.

Ligustrum vulgare; near Tannadice
Circæa alpina; and var. β intermedia
„ lutetiana; near Finhaven
Veronica officinalis, var. β of Linnæus; perhaps the allionii of Smith
„ montana; on the banks of the Esk
Salvia verbenaca; near Dundee
Valeriana locusta
Aira scabro-setacea of Knapp's Gramina Britannica
Poa alpina; by the side of the rivers Esk and Isla
„ glauca
„ compressa
Briza media, var. with a white panicle
Festuca myurus
Bromus multiflorus
„ secalinus
„ pratensis
„ arvensis; but rare
* „ tectorium
Avena strigosa
„ flavescens
„ pubescens
„ pratensis
Lolium temulentum
„ arvense
Galium erectum

Galium mollugo
„ boreale
„ verrucosum of Smith's Prodromus Floræ Græcæ; new to Britain
„ spurium; near Forfar: it has been found in no other place in Scotland
I have also found another species of Galium near Kinnaird, which seems a non-descript, coming near the Galium Austriacum of Jacquin's Flora Austriaca
Cuscuta Europæa; generally on flax, and seems a very destructive weed; it mats it altogether like a parcel of matted hair
Sagina apetala; but rare in Angusshire, though common in some other parts of Scotland
Lithospermum officinale
„ arvense, seems to be brought along with the seed of wheat, as it is become very common of late years, since the culture of wheat became more general
Anchusa sempervirens
Cynoglossum officinale; but chiefly near to the sea
„ sylvaticum; west from Dundee, rare
Symphytum officinale; and var. fl. rubro
„ tuberosum
Primula elatior; near Glammis
Anagallis arvensis
Convolvulus arvensis; common near Dundee
„ sepium
Campanula glomerata
Viola hirta
„ odorata
„ lutea
Verbascum Thapsus; and var. flore albo; the latter near Airly Castle
Atropa belladonna; this is to be found in the Den of Bonnetown, near Montrose: it is one of our strongest vegetable poisons. Its beautiful shining black berries, about the size of a small cherry, and not disagreeable to the taste, often allure children and unwary people to eat them, and they sometimes prove fatal. Dr. Smith assures us, that when it has been for any length of time in the stomach, it is impossible to save the unhappy patient from falling a victim, as no antidote is yet known; he adds, that all acids and alkalies, milk and oils, are alike ineffectual, as it makes its principal attack on the nervous system
Solanum Dulcamara
Chironia centaurium; to the west of Dundee
Chenopodium murale; rare
„ Bonus-Henricus
„ polyspermum; rare

Ulmus montana
„ campestris
Gentiana amarella
„ campestris
Daucus Carota
Oenanthe fistulosa; to the west of Dundee
Scandix odorata; but always near houses
„ pecten Veneris
„ anthriscus; but rare
Chærophyllum temulum; but rare
* „ aureum. I discovered this plant some years ago by the side of corn fields between Arbroath and Montrose; it was till then unknown to be a native of Great Britain
„ aromaticum. I discovered this plant in summer 1810, by the side of the river called Lunan and Vennie, not far from Guthrie, in a truly wild state; new to Britain
Carum Carui. The most common umbelliferous plant near Arbroath: there is no doubt of the plant being indigenous there
Pimpinella saxifraga; and also var. β dissecta
Viburnum Opulus
Sambucus Ebulus
Allium arenarium
„ vineale; near Dundee, hard by the sea side
Tulipa sylvestris; not far from Brechin
Convallaria majalis; near Inchewen, parish of Tannadice
Juncus glaucus
Rumex sanguineus
„ palustris
„ acutus
Trientalis europæa
Epilobium angustifolium
„ hirsutum; but rare
Vaccinium Vitis-Idæa
Polygonum Bistorta
„ viviparum
„ minus
Adoxa Moschatellina
Dianthus Armeria; on fields near the seat of Charles Gray, Esq., of Carse, the only place I have seen it in Scotland: I believe, indeed, it has been found nowhere else
„ deltoides. This beautiful plant grows on the north bank of the Lake of Forfar, as also on dry ground near the north-west corner of the Lake; and on banks by the sea, to the east of Arbroath
Silene anglica; but rare
„ noctiflora; in sandy corn fields near the Havens or Hains, by the sea side, the only known habitat in Scotland, where it can be reckoned truly indigenous

Stellaria nemorum
Sedum Telephium
„ villosum
„ album; and
„ reflexum; both on roofs of houses in Forfar
„ anglicum; on rocks near Dundee
Lychnis Flos-Cuculi, flore albo
„ Viscaria, and var. flore albo; on dry banks near Airly Castle
Cerastium tetrandrum; on roofs of houses in Forfar; common on the sea coast
„ arvense
„ aquaticum; near Dundee, but rare
*Spergula maxima; *nova species*
subulata
Sempervivum tectorum; on house-tops
Prunus Padus
„ domestica; hedges
„ insititia
Pyrus communis
„ Malus; both in hedges near Glammis
Spiræa salicifolia
Rosa tomentosa
„ scabriuscula
„ collina
„ cæsia
Rubus saxatilis
„ corylifolius
And a new species. It grows near the waterfal called the Reeky Linn, on the water of Isla
Potentilla argentea. I observed this plant on rocks not far from the Loups of Kenny, near Airly Castle, but very rare; but common on rocks on Seedlay Hills
Potentilla reptans; near Arbroath, rare
„ verna; on rocks near Dundee
Geum rivale, var. β of Flora Brit. the Geum intermedium of Withering; certainly a distinct species
Comarum palustre var. β
Aquilegia vulgaris
Thalictrum minus; in sandy stony places in the high lands, and by the sea side
Ranunculus auricomus
„ bulbosus, flore pleno. I found this on the south bank of the Lake of Forfar
„ acris, flore pleno; in meadows; this variety rare
Caltha radicans. I found this about the year 1790, in a ditch that runs from the farmhouse called Haltoun, on the estate of Charles Gray, Esq., of Carse. Considering it as a var. of C. palustre, I sent it afterwards to London, where it was ascertained to be a distinct species
Teucrium Chamædrys; but always near houses
Lamium nova species, which I propose to call *intermedium:* it is perfectly

distinct from all the known species: in cultivated fields

Galeopsis versicolor

Origanum vulgare, and likewise var. flore albo

Thymus Acinos; near the village called Welltown, about one mile south of Forfar

Scrophularia vernalis; near Lower

Myagrum sativum; by some botanists called Alyssum sativum

" orientale; in corn fields, and along with the other among flax. These two plants belong to the genus Alyssum, on account of their inflated and many-seeded silicles. New to Britain

" paniculatum; near the village of Crichie: I discovered it there several years ago; it has never been met with any where else in Britain. This is a true myagrum, and not an alyssum

Thlaspi arvense; in corn fields, but rare, as near Brechin and Arbroath

" campestre

" hirtum, var. with smooth silicles, according to Dr. Smith. See *Flora Britannica*. There is little doubt, however, of this being a distinct species, and not a mere variety; it is very distinct in its appearance and in its silicles, which are of a different form. I have cultivated both varieties for several years past, and am convinced they are permanently distinct. Grows opposite to a mill on the south side of the river Esk, near Kinnaird

Iberis nudicaulis. This beautiful little plant grows on the estate of Pitruchie, about one mile south of Forfar; it is of rare occurrence in Scotland

Cardamine amara; in dens by the sides of rivulets

Sisymbrium terrestre

" Sophia; near the confines of Angusshire, on the Perth road

Cheiranthus fruticulosus adorns the ruins of several antient buildings; such as the Abbey of Arbroath, and one near the Baikie; also on rocks by the sea shore

Hesperis inodora; on banks near Airly Castle

Turritis glabra; near Kinnaird

" hirsuta; on rocks and dry banks

*Turritis nov. sp.; near Lochlee, in Glen Esk, growing on rocks. I observed it in 1801. Having shewn specimens to Mr. J. T. Mackay of Dublin, when he paid me a visit at Forfar in 1811, he recognised it as the same which he had found in Ireland, and which Dr. Smith has considered as T. alpina, Lin.
Brassica campestris; corn fields near Forfar
Geranium sylvaticum, var. flore albo
" pusillum
" sanguineum
Fumaria capreolata
" claviculata
Genista anglica
Ulex nanus
Orobus tenuifolius of Roth; near Kinnaird
Ornithopus perpusillus; near Newtyle, but rare
Astragalus glycyphyllus
" hypoglottis
Trifolium scabrum
" striatum
" medium. This last species produces a number of leaves, and as it thrives well on cold tilly pastures, unfavourable to most other vegetables, it deserves a trial, as its appearance is very flattering, and cattle and horses are fond of it
Botus corniculatus
" major
" lathyroides; near Forfar, but rare in other places. All these three thrive well on poor soils, and in cold till, and if they were properly attended to, they would make a valuable addition to our pasture grasses. I named this latter species some years ago
Medicago sativa; near Dundee
Leontodon palustre
Hyoseris minima. There is a remarkable circumstance occurs with regard to this plant: when any muir ground is broken up, although there is no symptom of its having been ever ploughed, this plant never fails to make its appearance the first year; but after the field has been cultivated for some time, it begins to disappear
*Crepis pulchra; among the debris of the rocks of the hills of Turin and Pitsandly, but very rare
Hypochæris glabra
Carduus heterophyllus
" marianus
" tenuiflorus
Tanacetum vulgare
Senecio saracenicus; but always near houses
Doronicum Pardalianches; near Kinnaird

Pyrethrum Parthenium
Anthemis Cotula
" tinctoria
" arvensis
Centaurea Scabiosa, and var. flore albo
" nigra, var. flore albo
" jacea; found by Mr. Young near New-Tyle
Orchis conopsea
" mascula, var. flore albo
" bifolia
" latifolia, var. flore incarnato
Satyrium albidum
" viride
Ophrys ovata
" cordata
Malaxis paludosa
Littorella lacustris
Salix purpurea
" helix
" Lambertiana
" rubra
" triandra
" lanceolata.—All these are good basket willows
† " Russelliana, or Bedford willow. The bark of this species is the best adapted for tanning of any of the willows
" pentandra
†Salix nigricans
" bicolor
" petioloris. This forms a fine tree, and one of our best hoop willows
" vitellina. A good basket willow
" fragilis. The bark is sometimes used for tanning
" malifolia
" argentea
" fusca
† " cinerea
" aurita
† " aquatica
† " oleifolia
" hirta
† " caprea
† " stipularis
† " alba
" viminalis. This is the one most used for hoops in this country
" mollissima

Those marked thus †, form good trees

Myrica gale
Populus nigra
" tremula
Osmunda lunaria
Anethum fœniculum; on rocks on the foreside of Seedlay Hills, the only habitat I know for it in Scotland

Among the pastures in wet soils, and by the sides of rivers, a considerable number of the different species of Equisetum, or horse-tail, are to be met with, particularly,

Equisetum arvense
" palustre
" sylvaticum.—These plants are known to be hurtful to cattle that browse upon them, probably from the rough angle of their stems acting upon the intestines and injuring them. May not this help to account for some of the diseases which prove fatal to cattle, hitherto not satisfactorily explained?

The genus Agrostis, or Bent-grass, is abundant. A Dr. Richardson of Ireland, has written strongly in favour of this family of grasses; but from his publications, which I have of late fallen in with, it pretty evidently appears, that this writer knows not one family of grasses from another, far less is able to distinguish the different species of each family; for his *fiorin grass*, as is evident from his own words, palpably includes every species and variety of British agrostis, with couchy roots, or trailing shoots; for he says that it grows in every bog or marsh, and in every soil and situation, from marshes to the tops of hills, and on heaths. How any one could suppose the fiorin grass to be exclusively the Agrostis stolonifera, I am at a loss to understand; for I had three specimens sent me from gentlemen, who had their plants from Dr. Richardson himself: one of them proved to be the Agrostis stolonifera, another the Agrostis vulgaris, and a third the Agrostis canina. Still more lately, I have received a dried specimen of the Fiorin grass, procured from Dr. Richardson's own hands, and sent me from Ireland; and this proves to be another species, viz. Agrostis alba. This was nothing else than I would have expected, after reading the Doctor's books. I may here observe, that I have never seen the Agrostis stolonifera on dry elevated pastures. Now, what is this celebrated *fiorin grass* of Dr. Richardson? It seems to be a mixture of all the tribe of couchy grasses, held equally in detestation by the farmers and their cattle; and we in Angusshire are apt to judge of the industry of the farmer, in proportion as he has eradicated these grasses, the abundance of which tends so much to depreciate the value of the ground he possesses. In the west of England, the Agrostis stolonifera is held in equal detestation by the farmers, and stigmatized by the name of *Black squitch*.

The agrostides are the worst to eradicate of any grasses I am acquainted with. Indeed, when they get possession of wettish clay soils, it is the next thing to impossible to get clear of them.

I am bold to say, that if these grasses, so strongly recommended by Dr. Richardson, come really to be introduced among farmers, it will prove the greatest barrier in the way of improvement to agriculture that has ever yet taken place. But when a man like Dr. Richardson, who is plainly neither a botanist nor an agriculturist, comes forward with confidence, recommends to intelligent Scots farmers to lay down their arable fields with a grass which it has been their constant study through life to eradicate, the absurdity is so great, that there is reason to hope that little harm will ensue. The agrostides are grasses that totally

destroy rye-grass about the third year after sowing: the fields then become overrun with these grasses, and nothing but necessity ever compels the cattle to eat them. Dr. Richardson adds, that he supposes that the fiorin grass possesses an antiseptic quality, which prevents it from running into putrefaction so soon as other grasses. But I can assure that gentleman, that the agrostides on this side of the Irish Channel possess no such quality; they being here as ready to run into putrefaction as any grass whatever. He likewise adds, that Irish cattle give fiorin the preference to all other grasses: Our cattle, on the contrary, give every other grass the preference to the agrostides.

In digging in dry banks, about two or two and a half feet below the surface, if the soil is good, will be found the Lycoperdon tuber, the truffle, or solid puff-ball, so much esteemed by people of rank in England. In trenching up my garden lately, I found several of them. In England, dogs are trained for the purpose of finding them.

PLANTS TO BE FOUND ON THE SEA SHORE.

If the botanist, in taking his tour, begins at the North Water Bridge, the first thing that will arrest his attention is the beautiful grass called Elymus arenarius, and along with it he will find the Festuca rubra, one of our best grasses; also Triticum junceum, Carex arenaria, and the Arundo arenaria, commonly called Sea-bent: this grass, although much neglected, is not destitute of utility; it is the grass which of all others possesses in an eminent degree the advantage of being furnished with strong running roots, and of growing in loose dry sand, and, by means of these roots, arresting the blowing sands so destructive in some parts of the kingdom. In some counties in England, accordingly, which have a considerable quantity of sandy sea coast, the pulling or destroying of this grass is prohibited. The botanist will also find, though sparingly, the Phalaris arenaria. There is also what I take to be a non-descript species of Aira, or else the Aira cristata β of Linnæus. The sandy beach is here adorned with the delicate flowers of the Bunias cakile, the Cakile maritima of Willdenow's Species Plantarum.

As the collector comes nearer to Montrose, he meets with the Thalictrum minus; and also the Eryngium maritimum, whose singular foliage seldom fails to attract the notice of every man of curiosity. In cultivated fields near Montrose, he will find the Carduus tenuiflorus and Lamium incisum, rather of rare occurrence

in Angusshire. By the road side, in coming from the North Water Bridge, he will find the Carex divisa, one of the rarest carices. Near what are called the Back Sands, he will at ebb-tide find plants of the Zostera marina; and on those sands, and in salt-marshes among them, Chenopodium maritimum, Triglochin maritimum, Scirpus maritimus, and a variety of Scirpus lacustris, Carex distans and vulpina, Salicornia herbacea, and two varieties, which may possibly prove distinct species; also Arenaria marina and peploides, Poa maritima and Poa distans, and Juncus bulbosus. I have there observed likewise the Aster tripolium which had a magnificent appearance, the flower-stems being eighteen inches high, and strongly resembling some of the beautiful species of that genus from North America.

As the botanical inquirer proceeds along the coast towards Arbroath, he will find the rare moss called Grimmia maritima, and among the rocks, he will observe the Artemisia Gallica and maritima, Silene nutans, Vicia lutea, and Reseda lutea; and in marshes Schœnus rufus; and in dens near the shore, is the rare Allium ampeloprasum, the only place where it is known to grow in Scotland. Near the promontory called the Red Head, on rocks, is the Lathyrus sylvestris, which is a rare plant; Carlina vulgaris, Asplenium marinum, and Scolopendrum vulgare. Near to the town called Achmithie, is the Asperugo procumbens, which grows also at the village called Westhaven. Near the village called Torenshaven, is that truly beautiful plant, the Pulmonaria maritima, whose elegant glaucous leaves, and bright blue and purple flowers, form a fine contrast among the stones of the beach. Here also grows Mentha hirsuta of Linnæus, and the Gymnostomum obtusum, which is a rare moss in Scotland. On the beach in several places occurs the Salsola kali, one of the plants employed to produce barilla. The elegant Glaux maritima is common in many places.

To the eastward of Arbroath, plenty of the Allium carinatum, and Eryngium maritimum are found; and the Parietaria officinalis is in plenty about the rocks and old buildings. The Eupatorium cannabinum is not uncommon. Near to Wormiehills, Poa procumbens appears, and also a non-descript species of Festuca. On the tops of houses at Wormiehills I observed plenty of the Saxifraga tridactylites. The Carum carui, known by the name of Caraway, is common, but is generally considered as a doubtful native: the botanist will, however, be fully satisfied of its being truly indigenous to this coast; it is indeed by far the most common umbelliferous plant in the neighbourhood of Arbroath; its seeds are often put into loaf-

bread and also among the oatmeal baked into cakes by the peasants; they are also sometimes used for giving a flavour to cheeses. The Scabiosa columbaria is plentiful; and the beautiful Convolvulus soldanella, whose large rose-coloured flowers makes a fine appearance among the arid sand, will not fail to attract the botanist's notice: this is the only place I have observed these two plants in Scotland. That elegant plant, the Gentiana amarella, is common; and Erigeron acre, Phalaris arenaria, Pyrethrum maritimum, Chenopodium maritimum, are not unfrequent. The beach is covered everywhere with the Atriplex laciniata; and around Arbroath, as well as Dundee, grows plenty of the Hordeum murinum.

In proceeding a little further to the westward, the tourist arrives at the Sands of Barrie, which offer an ample field for botanical pursuits. There he will find most of the coast-plants already taken notice of. The Phalaris arenaria, and Erigeron acre, are there in the greatest abundance. Some years ago I observed there the Equisetum variegatum, new to Britain; and about the same time, I discovered a rare moss, which I take to be the Meesia longeseta of Hedwig, hitherto unnoticed in Britain: this moss is easily distinguished, from the great length of its pedicles. I have likewise observed on the down, the Grimmia nigrita and Grimmia inclinata, both rare mosses. Carex incurva, and Ophioglossum vulgatum, occur here; and this is the only place where I have observed them in Angusshire. A very singular variety of the Gentiana campestre, without any flower-stem, is found here. Sagina maritima may also be added to the list of Barry rarities; it is a rare species, which I first observed in the Isle of Skye, and on the summit of Bennevis, in 1794.

As the botanist approaches to Broughty Castle, he will observe the Sedum villosum and Sedum anglicum, the former by no means common in Angusshire; and the Trifolium ornithopodioides, a rare plant in Scotland; and between Broughty Castle and Dundee, on the rocks, he will notice the Spirea filipendula, and Potentilla verna, being the only place I have observed them in Angusshire; together with the Carduus Marianus, and a variety with green leaves: Grimmia maritima, and Asplenium ruta muraria, occur on the same rocks. By the sea side, in marshes, he will find, though sparingly, Oenanthe crocata, or hemlock dropwort: this is a strong vegetable poison; several instances are on record of its fatal effects; its roots consist of small round tubers, in bundles, like skirrets, and children and the unwary sometimes take them for the roots of the Bunium

flexuosum, the earth nuts or earth chesnuts, in Scotland called by the name of *Arnots*.

In the fields by the shore, in several places, is found the Centaurea intybacea of Willdenow's Species Plantarum. I first distinguished this beautiful and rare plant some years ago: it is new to Britain, and must have been confounded with the Centaurea scabiosa, which it very much resembles, and often grows intermixed with. On walls about Dundee is found a variety of Poa compressa. On the walls of the old Tower of Dundee, is plenty of the Asplenium ruta-muraria, the only place where this little plant is to be found in plenty in Angusshire.

Along the side of the Tay, to the westward of Dundee, may be seen the Sagina maritima, Allium viniale, Triglochin maritimum, Aster tripolium, Poa maritima, and a new species, which I propose to call *Poa depauperata*, from its starved-like appearance. There likewise grows on the banks of the Tay an uncommon species of Aira, which may perhaps prove to be a non-descript. In the woods, Paris quadrifolia occurs; and on rocks we find Asplenium septentrionale. Saxifraga nivalis grows on the higher hills, and should have been formerly mentioned.

The larger plants contained in this List are to be seen in a growing state in my Botanic Garden at Forfar, where I have now the most extensive collection of hardy plants in Scotland.

SEA PRODUCTIONS.

The first to be noticed is the genus Fucus, not only on account of the great number of species, but because they are the most conspicuous marine plants, and those generally understood by the term Sea-weeds. The following is a list of such as I have observed in the course of my botanical excursions along the shore:

- Fucus sinuosus
- „ sanguineus
- „ ruscifolius
- „ membranifolius
- „ ovalis
- „ siliquosus
- „ ligulatus
- „ esculentus; *hen-ware* of Angusshire
- „ serratus
- „ vesiculosus; and var. spiralis
- „ cerinoides

- Fucus alatus
- „ dentatus
- „ laceratus
- „ laciniatus
- „ ciliatus
- „ bifidus
- „ palmatus; the *dulse* of this country
- „ edulis
- „ phyllitis
- „ saccharinus
- „ digitatus
- „ bulbosus

Fucus rubens
„ crispus
„ mamillosus
„ canaliculatus
„ loreus
„ nodosus
„ pygmæus
„ aculeatus
„ coccineus
„ plumosus
„ rotundus
„ lumbricalis
„ plicatus

Fucus confervoides
„ flagelliformis
„ filum
„ lycopodioides
„ subfuscus
„ purpurascens
„ califormis
„ articulatus
„ opuntia
„ amphibius
„ hypoglossum
„ pinnatifidus

The following species of Ulva occur:

Ulva purpurascens
„ latissima
„ lactuca
„ compressa
„ lanceolata

Ulva laciniata
„ linza
„ umbilicalis
„ fistulosa
„ intestinalis

Of the genus Conferva, many species are found, a few of which may be named:

Conferva polymorpha
„ pilosa
„ rubra
„ comoides
„ rupestris
„ glomerata
„ confervicula
„ littoralis
„ æruginosa
„ scoparia
„ purpurea

Conferva verticillata
„ capillaris
„ funicula
„ elongata
„ nodulosa
„ diaphana
„ fucoides
„ coccinea
„ villosa
„ repens
„ atro-rubescens

The following species are also to be met with in fresh water, and on damp walls, or on the ground:

Conferva velutina
„ atro-virens
„ fracta
„ gelatinosa
„ atra
„ fluviatilis
„ purpurea
„ aurea
„ rubiginosa
„ frigida
„ flexuosa

Conferva amphibia
„ ocracea
„ sordida
„ lucens
„ decorticans
„ limosa
„ fontinalis
„ nitida
„ rivularis
„ muralis

This latter species grow on damp walls in crowded cities, and sends forth a fragrant smell. Dr. Smith thinks it may have a tendency to correct the bad air in such places; it colours the wall of a green colour, but its filaments are so fine as hardly to be seen with the naked eye.

The marine plants, although many of them are extremely beautiful, are neglected or overlooked by the greater part of mankind; yet they most certainly are highly useful in the economy of Nature, although we may be ignorant of their uses. We evidently see that they give shelter to many of the smaller tribes of marine animals, and a number of others are spawned upon them, and receive from them their nourishment during the first stages of life. Others, again, seem to depend almost entirely upon them for nourishment, as they are attached to them through life: Such, for instance, is the Lepas striata, some of the genus Serpula, and some of the Zoophyta, as the Flustra, Sertularia, &c. The beautiful Patella pellucida I have often observed on the larger species of fuci; the animal that inhabits that shell seems to derive a great part of its nourishment from that tribe of vegetables. The following are esculent, viz. the Fucus palmatus, known by the name of *dulse* or *dilse:* The crispus and mamillosus are eaten among it: the F. pinnatifidus, known by the name of *pepper-dulse:* the F. esculentus, which is known by the name of *hen-ware* on the Angusshire coast: F. edulis, which is eaten promiscuously along with F. palmatus; and the stems of the F. digitatus and F. saccharinus, which are sold under the name of *tang* or *tangle.* Many of the fuci are eaten by cattle; and the whole of them are known to make excellent manure.

In some parts of Scotland, where they are extremely abundant on the shores, they are manufactured into kelp. The F. vesiculosus, nodosus, and serratus are principally used for that purpose; and on that account, Dr. Garnet, in his Tour through the Highlands, informs us, that in the Isle of Mull, some small farms which a very few years ago were let for L. 40 are, now let for L. 300 *per annum.*

The F. vesiculosus is strongly recommended by Dr. Russell in diseases of the glands. He says it is extremely serviceable in dispersing all scorbutic and scrofulous swellings. He recommends rubbing these with the vesicles, bruised in the hand till the mucus has thoroughly penetrated the parts, and afterwards washing the parts with sea water. He also says that scirrhosities in the mammæ have sometimes been dispelled by this treatment.

The many Confervæ growing in stagnated pools and ditches, give out a great deal of oxygenous air from their extremities, and hence tend to prevent putrescency in the waters during the summer months; and it is probable that the numerous Fuci, Confervæ and Ulvæ, are placed by the hand of Providence in the deep, in order to assist in preventing that vast collection of water from becoming putrid.

I shall conclude my observations on these tribes of vegetables, with the words of the celebrated Mr. Turner of Yarmouth, who has written a Synopsis of the British Fuci, and is publishing a more extensive work, with highly finished figures of all of them. "I can assure the philosophic naturalist (he says), that while the more stupenduous works of the Divine Hand arrest the attention of even the most careless observer, and in a language equally understood by all ages and all nations, declare the glory of God; these humble vegetables will, by the inquisitive mind, be found by no means wanting in affording additional proofs, both of the wisdom and beneficence of the Great Creator."

Having thus taken notice of the vegetables which are to be found in Angusshire, and such as are natives of the sea which washes it, or are thrown occasionally on the shore, (at least such of them as have fallen under my observation), I shall next take notice of the *Zoophyta*, which are the connecting link between the vegetable and animal kingdom. The chief of these are:

Sertularia thuja
" halecina
" loricata
" pumila
" operculata
" geniculata
" lendigera
" falcata
" eburnea
" rosacea
" tamarisca
" abietina
" cupressina
" argentea
" rugosa
" pluma
" antennina
" volubilis
" cuscuta
" filicula

Sertularia muricata
" uva
" myriophyllum. Of this I have only found one specimen on this coast
" dichotoma
" setacea
" spinosa
" polyzonias
" fastigiata
" syringa
" avicularia
" scruposa
" reptans
" frutescens
Pennatula phosphorea
Corallina officinalis
" elongata

Corallina rubens
Tubularia ramosa
„ indivisa
„ muscoides
„ fistulosa
Cellepora pumicosa
Millepora foliacea
„ polymorpha
Alcyonium digitatum; called *dead mens' toes*
„ schlosseri
„ gelatinosum. This, by some authors, is made an Ulva
„ ascidioides
Spongia tomentosa
„ stuposa
„ oculata
„ palmata
„ lacustris. This is not unfrequent near Forfar. I have observed it in the Lake of Rescobie, and also near Brigtown
Flustra foliacea
„ truncata
„ pilosa
„ chartacea
„ carbasea
„ dentata
„ bullata
„ membranacea
Hydra viridis, and
„ grisea; the common polypi. These two species are to be found in ditches in the neighbourhood of Forfar

Of the order *Infusoria*, among many, the following may be noticed:

Vorticella rotatoria
Trichoda cometa
Paramecium aurelia
Cyclidium glaucoma
Librio aceti
Veucophra fluida
Volvox globator. This animal is remarkably common in the summer months in the old tan-pits near what is called the Dam at Forfar: it is only visible to the naked eye when the sun shines, and then the water seems tinged of a green colour with these minute animals
Monas lens
Enchelis seminulum

It is scarcely necessary to mention, that the animals belonging to this order for the most part require a microscope to detect them, being so small as to elude the naked eye.

MAMMALIA.

Of the *Mammalia* class we have no animals of the order *Primates*, but two, viz.

Vespertilio auritus; eared bat
Vespertilio murinus; common bat

Of the order *Feræ*, we have the following:

Phoca vitulina; common seal
„ barbata; great seal
Mustela lutra; common otter: is not unfrequent on the banks of some of the rivers
„ foina; common martin. This is rather a rare animal in Scotland; one of them was shot in the Wood-hill of Glammis in the year 1808
„ putorius; *foumart*, or polecat
„ erminea. This animal is rare in Angusshire: I never saw but one, which was near the Mill of Brathens, about four miles north of Brechin; this was upwards of thirty years ago
Mustela vulgaris; common weesel, or *Whitret*; not unfrequent
Ursus meles; the badger, or *Brock*, is rather rare in Angusshire
Talpa europæa; common mole. I have seen a beautiful variety of a pure white colour, and another variety of a dun colour: both varieties may be considered as of rare occurrence
Erinaceus europæus; hedgehog. This animal was formerly rare in Angusshire, but of late years it has appeared in tolerable plenty

Of the Order *Glires*, we have the following:

Mus rattus; the black rat. This is the only species I have seen in the town of Forfar, and it is not rare in all the inland parts of Angusshire; but it has become very rare in most parts of Britain, and is still becoming scarcer, as the brown rat has nearly extirpated it in many parts of the island
„ decumanus; brown rat, or Norway rat. Common in the sea-port towns in Angusshire; a very destructive animal
Mus musculus; common mouse. I have seen a variety of this of a pure white colour
„ sylvaticus; field mouse.
„ amphibius; water rat; common
„ agrestis; short-tailed field mouse. I have seen this species in my garden in Forfar: the female seem very much attached to her young, and will brave

every danger in order to protect them
Lepus variabilis; alpine or white hare. Mountains of Clova: it is not near so timid as the common hare
Lepus cuniculus; rabbit; it is rare in Angusshire; perhaps hardly a native

Of the Order *Pecora*, we possess but three species belonging to one genus:

Cervus elaphus; the stag: sometimes to be found on Clova mountains, but rare; and in the wood of the Forest Muir, near Forfar
„ dama; fallow deer: it is rare in a wild state in Angusshire, but is in a tamed state at Kinnaird and Panmure
Cervus capreolus; the roebuck: sometimes to be found in the woods near Forfar. I have seen two or three of them in these woods some years ago: I have also seen them on the Seedlay Hills, and in the woods around Glammis

Of the Order *Cete*, we occasionally find the following:

Balæna mysticetus; common whale; sometimes on the coast
„ physalus; the finfish. I observed a skeleton of this species to the east of Dundee two years ago
Delphinus phocæna; the porpesse
„ delphis; the dolphin

As to the whales that were stranded up the Frith of Tay, I cannot positively say what species they belonged to, as I had no opportunity of seeing them. From the description given of them, they appear to have been of the kind first distinguished by Mr. P. Neill, (in his Tour to Orkney), by the name of *Ca'ing whale*, and afterwards figured and described by Dr. Traill of Liverpool, (in Nicolson's Journal), under the title of *Delphinus melas*.

BIRDS.

The *Ornithology* of Angusshire might furnish materials for a volume. I shall, however, very much compress my remarks on the subject.

Of the Order *Accipitres*, we find a considerable number:

Falco albicilla; the erne: on the mountains of Clova, and by the head of the West water: there is a rock near the head of it called the *Erne skellie*, where these birds generally breed
" ossifragus; the sea eagle, is to be seen sometimes on the coast
" chrysaëtos; golden eagle: mountains about the head of Clova
" fulvus; ring-tailed eagle. I observed one of these on Wirron Hill, about twelve miles north from Brechin in 1797
" milvus; the kite, or *Gled*
" ater; black eagle: on heaths and low hills
" buteo; the buzzard. In a nest of one of these birds in the wood at Newmill, belonging to Colonel Kinloch, on breaking an egg, the bird contained in it had two heads
" apivorus; honey buzzard
" æruginosus; moor buzzard: on heaths. I have seen this species on the hills of Turin and Pitscandly
Falco palumbarius; the gosshawk. This bird is not very common in Angusshire
" gentilis; gentle falcon: on our high mountains
" peregrinus; peregrine falcon. I remember of seeing one of this species in the possession of the Laird of Balnamoon's grandfather, and of his servants hunting with it about the year 1771. It is recorded of one of this species that eloped from its master in the vicinity of Forfar, on the 24th of October 1772, with four heavy bells on its feet, that it was killed on the morning of the 26th at Mostyn in Flintshire. This shews the great rapidity of its flight
" candicans; gyr-falcon. I observed one of this species on the estate of Mr. Robertson Scott of Hedderwick in September 1810; but I rather think it is rare
" cyaneus; hen-harrier. I have seen this species several times in the neighbourhood of Forfar

Falco pygargus; the ring-tail: not unfrequent
„ tinnunculus; the kestril. This species is called often in Angus-shire, by the country people, *Willie whip the wind*
„ nisus; the sparrow-hawk: not unfrequent
„ subbuteo; the hobby: it is rather rare
Strix otus; horned owl
„ brachyotus; short-eared owl: on the mountains of Angusshire
„ flammea; white owl: common
„ ulula. I saw this species in the woods at Balnamoon, where they used to hatch every season
Lanius rufus; wood-chat

Of the Order *Picæ*, there occur the following:

Corvus corax; the raven: on the mountains
„ corone; carrion crow
„ frugilegus; the rook: common
„ cornix; the hooded crow. These birds were much more common some years ago than they are now
„ monedula; the jackdaw
„ glandarius; the jay. Within these few years they have frequented the woods about Forfar, but formerly they were not to be seen: they are common about the woods of Glammis, Brig-town, and Kinnettles
„ pica; the magpie
Corvus graculus; the Cornish chough: on the mountains of Clova
Cuculus canorus; cuckoo
Picus viridis; green wood-pecker
„ medius; middle spotted wood-pecker
„ minor; lesser spotted wood-pecker
Sitta europæa; nut-hatch. One of this was brought me from the woods near Tannadice in 1807
Alcedo ispida; the common king's-fisher. This beautiful bird is sometimes seen in the wood of Glammis and in the wood of Newmill
Certhia familiaris; creeper. I have seen this bird among the woods by the side of the water of Esk

Of the *Anseres*, we can boast a considerable number:

Anas cygnus; wild swan. A few pairs of these visit the lakes in the neighbourhood of Forfar; at least I have observed them in 1809 and 1810: they are often to be seen in the lake called the Loch of the Garth, between Forfar and Kirriemuir
" olor; tame swan: they are occasionally kept by gentlemen: two of them were long kept in a lake called Loch Feithie, by George Dempster, Esq. of Dunnichen
" tadorna; shieldrake: not unfrequent in the winter season near the river Esk
" fusca; velvet duck: sometimes to be seen on our coast
" anser; wild goose
" segetum; bean goose
" bernicla; the brent goose
" mollissima; eider duck, or *Dunter*
" clypeata; shoveler
" streptera; the gadwall, or grey. I have seen this species in the lakes of Rescobie and Balgavies
" clangula; the golden-eyed duck
" penelope; the wigeon: in the lakes of Rescobie and Balgavies
Anas glacialis; long-tailed duck: on the coast
" ferina; the pochard: this is rare
" querquedula; the garganay, or summer teal: in the lake of Forfar
" crecca; teal duck: lake of Forfar
" boschas; wild duck
" fuligula; tufted duck: in the lakes
Mergus merganser; the goosander: on the coast
" serrator; red-breasted goosander: coast
Alca arctica; puffin: on the shore
" torda; razor-bill: on the coast
Procellaria pelagica; stormy petrel, called by the sailors *Mother Carey's chicken*
Pelecanus carbo; the corvorant, or scart: some of these birds occasionally visit the lake of Forfar, and sometimes sit for a whole day on the stakes driven into the lake for dragging marl
" graculus; the shag: on the coast
" bassanus; the gannet, or *Solon goose*. This is sometimes to be

seen on the coast
Colymbus grylle; the spotted guillemot
„ minor; lesser ditto
„ troile; the scout, or foolish guillemot
„ arcticus; black-throated diver: on the coast
„ stellatus; speckled diver
„ minor; little grebe. One of these was taken in my garden at Forfar in winter 1807
Larus rissa; kittiwake
„ tridactylus; the tarrock, or three-toed gull
„ hybernus; winter gull
„ canus; common gull
„ erythropus; brown-headed gull
Larus nævius; the wagel
„ marinus; black-backed gull
„ fuscus; the herring gull. This species is easily tamed: I once kept one of them for three years
„ ridibundus; black-headed gull. In Angusshire it is called *pictarny*
„ parasiticus; the arctic gull
„ crepiditatus; black-toed gull
Sterna hirundo; the sea swallow. In Scotland, particularly in Angusshire, it is called *Willie Fisher:* common on the water of Esk
„ minuta; the lesser sea swallow
„ fissipes; the black tern: common on the sands of Barry

Of the Order *Grallæ*, we have the following:

Ardea major; common heron. This bird builds on trees in the wood of Newmill
„ stellaris; the bittern. One of these was shot in the White Mire, near Forfar, in 1789: it is sometimes to be seen in the lake of Rescobie, but it is a rare bird
Scolopax arquata; curlew: breeds on the mountains
Scolopax phæopus; whimbrel. Along with the curlew
„ rusticola; woodcock
„ gallinago; the snipe
„ gallinula; jack-snipe
„ glottis; greenshank: sometimes on the coast
„ calidris; redshank: breeds on heaths near Forfar

Scolopax lapponica; red godwit; a rare bird with us
„ ægocephala; common godwit
Tringa vanellus; the lapwing: called in Angusshire *Teuchet;* they are not near so numerous as they were some years ago
„ interpres; the turnstone
„ cinerea; ash-coloured sandpiper
„ hyperborea; red phalarope
„ hypoleucos; common sandpiper, or sand lark
„ cinclus; the purre
„ islandica; red sandpiper
„ squatarola; grey sandpiper
Charadrius hiaticula; the ringed plover
„ pluvialis; golden plover: breeds on the hills
Charadrius himantopus; long-legged plover. I once saw one bird of this species on the mountains of Clova: I have never observed but another, which was on Ben-Lawers, in Perthshire, in August 1793: it is a rare bird, and I believe but few naturalists have seen it alive
Hæmatopus ostralegus; the sea-pie: frequent by the side of the Esk
Fulica chloropus; common water-hen
„ atra; common coot
„ aterrima; greater coot. The above three in the lake at Forfar
Rallus crex; the rail, or *Corncraik*
„ aquaticus; water rail

Of the *Galline* or *Grous* tribe, Forfarshire possesses,

Tetrao tetrix; the black cock. Two of these birds were shot on Turin Hill in the winter of 1794; they occur also on Clova mountains, but rare
„ lagopus; the ptarmigan: on the high mountains of Clova
Tetrao attagen; red grous or *muirfowl.* This species is becoming very rare of late years, and if gentlemen do not fall upon means to prevent their destruction, they will certainly very soon become extinct. I have seen more of them

about twenty years ago in walking two or three miles, than I have of late in walking sixty miles

Tetros perdix; the partridge

Of the Order *Passeres*, a great variety occurs:

Columba œnas; common pigeon: frequent on the rocks by the sea side

" palumbus; the ring-dove, or wood pigeon. This bird is easily tamed: I have one of them which for the most part lives in my house; it is so tame as to eat out of one's hand

Alauda arvensis; the sky-lark

" pratensis; the tit-lark

" arborea; the wood-lark: in woods near Forfar

Sturnus vulgaris; the starling: frequent on the mountains

" cinclus; water ouzel, or *Water craw*

Turdus viscivorus; the missel-thrush

" pilaris; the field-fare

" iliacus; red-wing

" musicus; the *mavis*, or throstle

" merula; blackbird

" torquatus; ring-ouzel: on the mountains

Ampelis garrulus; the Bohemian chatterer

Loxia curvirostra; the cross-bill; and

" enucleator; pine cross-beak. These two species of Loxia have come in great numbers to the woods of Glammis and Lindertis, and totally destroyed the whole larch, and fir cones for these two years past

" pyrrhula; the bulfinch

" chloris; the green-finch. A few years ago I observed a white variety of this species near Forfar: I observed it for two winters

Emberiza nivalis; snow bunting, or *snow flake*. I once tamed one of these birds: it seemed to live very well in confinement, and was cheerful; it lived with me for four years

" mustellina; the tawny bunting

Emberiza miliaria; common bunting
„ citrinella; the yellow hammer. This beautiful and innocent bird is terribly persecuted by the young children in many parts of Scotland, under the name of *Yellow-yite*, or *Yaldring*
„ schœniclus; reed bunting: common near the lake of Rescobie
Fringilla cœlebs; chaffinch
„ montifringilla; the brambling
„ carduelis; the goldfinch. This bird has never been plentiful since the hard winter of 1795, which destroyed many
„ linota; the linnet
„ domestica; the sparrow
„ montana; mountain sparrow: on the mountains of Angusshire
Motacilla modularis; hedge-sparrow
„ salicaria; reed sparrow: among reeds by the sides of the lakes; but not common
Motacilla alba; the white wagtail
„ flava; the yellow ditto
„ œnanthe; the wheat-ear
„ rubetra; whin-chat
„ rubicola; stone-chatterer
„ atrocapilla; the black-cap
„ rubicula; the red-breast
„ troglodytes; the wren
„ regulus; the golden-crested wren. This is a rare bird in Angusshire
„ trochilus; yellow wren
„ baarula; grey wagtail. I have seen this near Forfar
Parus major; great tit-mouse, or *ox-eye*
„ cœruleus; the blue tit-mouse. This bird hatches in my garden every year
„ ater; the cole-mouse
„ biarmicus; the bearded tit-mouse
Hirundo rustica; the chimney swallow
„ urbica; the martin
„ riparia; the sand martin
„ apus; the swift
Caprimulgus europæus; the goat-sucker: woods near Forfar

AMPHIBIA.

In Angusshire we have but few of the class *Amphibia*.

Of the Order *Reptilia*, we have:

Rana bufo; the common toad
„ temporaria; common frog. I have seen numbers of a beautiful variety of this species in the alpine rivulets on the mountains of Clova: they appeared as if trimmed with silver lace. I once observed one of this variety in my garden in Forfar some years ago
„ esculenta; the eatable frog. I have seen a few of this species about the lakes, but rather rare
„ gigantea; the gigantic frog of Lightfoot. I observed one of these about five miles east of Arbroath, in June 1797; it was about three times the size of the Rana temporaria. I suppose it is an inhabitant of salt marshes, and rare
Lacerta palustris; the warty lizard
„ aquatica; the water ditto
„ agilis; the nimble lizard; common on the Highland mountains, where it sometimes grows to a large size
„ vulgaris; common ditto: this species, as also the others, is called in Angusshire by the name of *Ask*

Of the *Serpentes*, there occurs only the following, and none of them are common.

Coluber berus; the viper, or *Adder*. This animal is now becoming very rare: we have it near the West Water, as at the foot of Wirron Hill, twelve miles north of Brechin, and the hills of Glenugg
„ prester; the black viper. I observed one of this species at the foot of the rocks at the head of Lochlee, in Glenesk, in 1795, the only one I have seen
Anguis eryx; the blue-bellied snake, or adder; on the mountains, but rare
„ fragilis; the blind-worm. Several of this species were found in the Moss of Restennet, near Forfar

Of the Order *Nantes*, the sea and rivers afford the following:

Tetrodon truncatus; the oblong sun-fish: sometimes on our coast
„ mola; the short sun-fish: on the coast, but rare
Syngnathus ophidion; the little pipe-fish
„ acus; the longer pipe-fish: on the coast, but very rare
Cyclopterus lumpus; the lump-fish
„ liparis; the unctuous sucker
Lophius piscatorius; the toad fish, or fishing frog, or sea devil
Squalus canicula; the greater dog-fish
„ catulus; the lesser ditto
„ galeus; the tope
„ vulpes; the sea fox
„ acanthus; the piked dog-fish
Raia batis; the skate
„ clavata; thornback
Raia oxyrhinchus; sharp-nosed ray
Petromyzon marinus; the lamprey: in the sea, and sometimes in rivers
„ fluviatilis; lesser ditto: in lakes and rivers
„ branchialis; the pride: in clear water. Lampreys were more common some years ago than at present: a number of the common people were much afraid of them, and many a strange story was told of them. They are called *Nine-eyed eels*

FISHES.

I now proceed to give a sketch of the *Ichthyology* of Angusshire.

Of the *Apodal* order, we find:

Muræna anguilla; the common eel
„ conger; conger eel; seemed to be much better known some years ago than at present: the name seems familiar even to the common people; they call it *Eve-eel*
Anarichas lupus; the sea-wolf: in Scotland called *Sea Cat.*
Ammodytes tobianus; the sand-eel

Of the *Jugulares*, the following occur:

Callionymus lyra; the gemmeous dragonet
„ dracunculus; sordid ditto
Gadus æglefinus; the haddock
„ morhua; the cod
„ luscus; the bib
„ barbatus; the whiting-pout
„ minutus; the poor
„ merlangus; the whiting
„ carbonarius; the coal-fish
„ pollachius; the pollack
„ merlucius; the hake
Gadus molva; the ling
„ mustela; five-bearded cod
„ tricirratus; three-bearded cod
„ brosme; the torsk
Blennius galerita; the crested blenny. One of these was lately taken at Acmithie, six miles east of Arbroath
„ pholis; smooth blenny
„ viviparus; the viviparus blenny

A considerable number of *Thoracica* occur, particularly

Gobius niger; the miller's thumb
Cottus cataphractus; the pogge
„ scorpius; the father-lasher
„ gobio; the bull-head. This species is sometimes to be found in the Esk
Zeus luna; the opah. I observed one of this splendid species cast ashore on the sands of Barry
Pleuronectes hippoglossus; the holibut. This species is sold in Forfar by the name of *Turbot*
„ platessa; the plaise
„ flesus; the flounder
Pleuronectes limanda; the dab
„ solea; the sole
„ punctatus; the whiff
„ maximus; the turbot
Sparus auratus; the gilt-head
„ pagrus; the red gilt-head. I bought a few of this species in Forfar market in the year 1798; they were taken near Westhaven
„ dentatus; toothed gilt-head
Labrus tinca; the wrasse
„ cornubicus; the goldsinny
Perca fluviatilis; the perch
„ marina; the sea perch
Gasterosteus aculeatus; the banstickle

Gasterosteus pungitius; the lesser stickle-back
" spinachia; the greater stickle-back. I have seen several of these on the coast
Scomber scomber; the mackrel
" thynnus; the albicore, or tunny: by some called the *mackrel-sture*, or great mackrel
Scomber trachurus; the scad, or horse mackrel
Trigla lyra; the piper
" gurnardus; the grey gurnard
" cuculus; the red gurnard. I observed one of this species cast a-shore on the Sands of Barry; and they are taken frequently off Montrose

Of the Order *Abdominales*, we have the following:

Cobitis barbatula; the loche: in rivers common
Salmo salar; the salmon
" eriox; the grey. This fish is not near so common as the salmon: it is indeed rather a rare species
" trutta; the sea trout
" fario; the common trout
" alpina; the char: in some of our alpine lakes, but rather rare
" eperlanus; the smelt: in Scotland it is known by the name of *Spirling* or *sparling*
" thymallus; grayling
Esox lucius; the common pike. This is often taken in the Lake of Forfar of a large size; one was taken in spring 1812, 27 pounds in weight and 4 feet long
Esox belone; sea pike
" saurus; the saury pike
Mugil cephalus; the mullet
Clupea harengus; the herring
" pilchardus; the pilchard
" sprattus; the sprat
Cyprinus phoxinus; the minow. The roach, dace, tench, or carp, which belong to this genus, and are so common in fish-ponds in England, I have never seen in Angusshire

INSECTS.

The following are a few of the *Insects* which I have observed in this country, but they are only a few of those to be found.

Scarabæus typhæus
„ nuchicornis
„ fimetarius
„ scrutator
„ conspurcatus
„ granarius
„ terrestris
„ sylvaticus
„ stercorarius; the dor-beetle: When it flies in the evening with a loud humming noise, it is thought by the country people to presage a fine day
„ testudinarius: very rare
„ melolontha; the cock-chaffer: flies in the evening. In flying it often strikes against persons and other objects, as if blind; and hence comes the common proverb, As blind as a beetle
„ solstitialis. This species is often hurtful to the leaves of the elm
„ nobilis
Lucanus parallelipipedus
„ caraboides. In the wood of the Forest-mui near Forfar
Dermestes lardarius
„ pellio. This insect is destructive to books
„ domesticus
Bostricus polygraphus
„ typographus: on fir trees near Forfar
„ scolytus; often destructive to elms
„ piniperda; on trees near Forfar, which it often destroys
Ptinus cerevisiæ
„ mollis; destructive to dried plants
„ fur; it is a most destructive insect in museums, and I have often experienced its mischievous effects
Hister unicolor
„ æneus
Gyrinus natator
Cistela pilula
Byrrhus scrophulariæ
Silpha vespillo
„ atrata
„ thoracica
Nitidula bi-pustulata
Cassida viridis
„ nobilis
Coccinella annulata
„ bi-punctata
„ 5-punctata
„ 6-punctata
„ 7-punctata

Coccinella 9-punctata
„ 13-punctata
„ 14-punctata
„ 22-punctata
„ conglobata
„ 14-guttata
„ oblongo-guttata
„ bi-pustulata
Chrysomela graminis
„ nemorum
„ euphorbiæ
„ tabida
„ transversa
„ cardui
„ fastuosa
„ vitellinæ. This species often destroys the leaves of the willow trees in my garden
„ polygoni
„ polita
„ populi
„ marginella
„ 20-punctata
„ anglica
„ aleracea
Limnius æneus of Müller
„ Volckmari
„ tuberculatus, Müller
Cryptocephalus sericeus
Auchenia asparagi
„ cyanella
Curculio cerasi; found on the cherry and pear trees, destroying their leaves
„ granarius; a destructive insect in granaries; the weevil
„ dorsalis
„ capreæ
„ ulicis
„ pomorum; hurtful to apple trees
„ pini. This species has destroyed a large plantation belonging to Mr. Meason of Lindertis, consisting of the Scots fir and larch
Curculio pyri. This insect is very common on the fruit trees of the garden walls of the garden at Kinnardy, and does a considerable degree of damage
Attelabus coryli
Clerus formicarius
Cerambyx bajulus. The larva of this insect perforates furniture made of fir
„ arcuatus
„ coriarius
Leptura aquatica
„ simplex
Lampyris noctiluca; the common glow-worm
Cantharis viridissima
„ fusca
„ livida
„ ænea
„ bi-pustulata
Elater sputator
„ elongatus
„ pectinicornis
„ obscurus
Cicindela campestris
„ riparia
Buprestis viridis
Dytiscus marginalis
„ cinereus
„ semistriatus
Carabus hortensis
„ catenulatus
„ ruficornis

Carabus vulgaris; and several others of this genus
Tenebrio molitor
Blaps mortisaga
Mordella bi-color
Staphylinus murinus
" maxillosus
" chrysomelinus
" hypnorum
Staphylinus riparius; and some others
Forficula auricularia; the earwig: in Angusshire called by the country people *Horned gollich*
" minor. This is rather rare

Of the *Hemiptera*, may be mentioned the following:

Blatta orientalis; found in some of the bake-houses in the seaport towns
Gryllus bi-punctatus
" gryllotalpa
" domesticus. These are sometimes found near bakers' ovens, but rare
" campestris
" viridissimus
" varius
" cœrulescens
" stridulus
" bi-guttulus
" grossus
Cicada cornuta
" spumaria. The larva of this species is the inhabitant on plants of the Cuckoo spit, or as it is called in Angusshire *Frog's spittle*
" viridis
" ulmi
" rosæ; and some others
Notonecta glauca
" striata
Nepa cinerea
Cimex lectularius; the bed bug: very common in some of the seaport towns, but happily not so common in the inland towns
Cimex littoralis
" clavicornis
" corticalis
" betulæ
" scaraboides
" baccarum
" juniperinus
" prasinus
" bicolor
" hyoscyami
" apterus
" campestris
" pratensis
" pini
" urticæ
" ulmi
" lacustris
" stagnorum
" personatus: and some others
Aphis; a great number of different species
Chermes; a great number of species
Coccus ulmi
" pilosellæ
" capreæ
" salicis. These two latter very common on some of the willows in my garden, particularly on the Salix viminalis and carinata

Coccus abietis.—A great many other species are to be found in Angusshire
Thrips physapus
„ juniperina

Of the Order *Lepidoptera*, we have the following:

Papilio napi
„ rapæ
„ brassicæ. The larvæ of these three are very destructive to cabbage plants in gardens, and render them very unsightly
„ cardamine. This beautiful species I have sometimes seen in my garden at Forfar
„ adusa. This beautiful and rare species I have seen in my garden: I have one preserved which was taken in it
„ hyale
„ hyperanthus
„ pamphylus
„ ægeria
„ jurtina
„ cardui
„ urticæ
„ atalanta
„ lucina
„ paphia
„ aglaja. I have one of these preserved which I found on the Sands of Barry; it is rare in Angusshire
„ argus
Papilio rubi
„ phlæas
„ linea; with several other species
Sphinx filipendulæ
„ atrapos
„ ligustri
Sphinx convolvuli
Phalæna bractea. This beautiful species is frequent in my garden
„ viridana
„ fagana
„ clorana
„ scabrana
„ quercana
„ obliquana
„ rosana
„ cynosbana
„ nemoralis
„ pallens
„ pronuba
„ segetis
„ maura. I observed this species at Westhaven in 1807
„ brassicæ
„ oleracea
„ citrosa
„ cerosa
„ euonymella
„ pratella
„ pascuella
„ tapezella
„ pellionella
„ fascitella. These two latter destructive to woollen clothes
„ dodecella
„ cembrella
„ granella
„ quercus
„ caja
„ coryli
„ erminea
„ lapricipeda; and many others of this numerous family

Of the *Neuroptera*, we find a number, particularly,

Libellula quadrimaculata
„ vulgata
„ depressa
„ vulgatissima
„ juncea
„ puella
„ virgo. This beautiful species I have seen several times in Angusshire
Ephemera vulgata; May-fly
„ vespertina
„ marginata
„ horaria. This species is very common about the Lake of Forfar; they live but for a single night
Phryganea nebulosa
„ grisea
„ flavicornis
„ rhombica
„ variegata; and some others
Hemerobius lutarius
„ perla
Panorpa communis

Of the Order *Hymenoptera*, the following are found:

Cynips rosæ
„ glechomatis
„ quercus-folii
„ quercus-petioli
„ quercus-gemmæ
„ fagi
„ viminalis
Tenthredo salicis; and several others
Sirex gigas
Ichneumon. Several species of this genus are to be found
Sphex sabulosa
„ fusca
Vespa vulgaris; wasp
„ parietum
„ muraria
„ arvensis
Vespa bifasciata
„ vaga; and others
Apis centuncularis
„ rufa
„ mellifica; common hive bee
„ conica
„ annulata
„ terrestris
„ virginalis
„ lapidaria
„ muscorum
„ hypnorum
„ acervorum
Formica herculanea
„ rufa
„ fusca
„ rubra

Of the Order *Diptera*, many species occur:

Oestrus bovis
„ equi, &c.
Tipula rivosa
„ crocata
„ oleracea
„ hortorum
„ triangularis
„ pratensis
„ regelationis
„ punctata
Tipula plumosa
„ motitatrix
„ littoralis
„ monilis
„ pusilla
„ marci
„ febrilis
„ vernans
„ phalanoides
„ palustris

Musca chamæleon
„ chalybeata
„ similis
„ vallata
„ Cæsar
„ pellucens
„ cadaverina
„ vomitoria
„ domestica
„ argentata. I observed this species near Panmuir
„ grossa
„ tremula
„ lateralis
„ canicularis
„ pluvialis
„ cellaris
„ meteorica
„ putris
„ pumilionis. The larva of this species is sometimes hurtful to wheat
„ frit. The larva of this is hurtful to barley
„ cupraria
„ aurata
„ angulata
„ cursitans
„ stercoraria
„ vibrans
Musca hyoscyami
„ germinationis
„ onopordinis
„ nemorum
„ tenax
„ fastuosa
„ pipiens
„ albimana; and several others of this extensive genus
Tabanus bovinus
„ tropicus
„ pluvialis
„ cæcutiens
„ autumnalis. These are known by the name of *Cleggs* in Angusshire
Culex pipiens
„ ciliaris
„ pulicaris
Stomoxys calcitrans
„ irritans
„ rostrata
Conops flavipes
Asilus forcipatus; and several others of this genus
Bombylius medius
Hippobosca equina
„ hirundinis
„ ovina

Of the Order *Aptera*, likewise, a number occur:

Lepisma saccharinum
Podura nivalis
„ aquatica
„ fimetaria; and others of this genus
Termes pulsatorium; the death-watch
Pediculus. Of this disgusting genus fifty-three or more species are reckoned natives; they are named by the animals they inhabit
Pulex irritans. This troublesome little insect is well known by the name of *Flea:* it is reported by some authors that it has been tamed, and has lived six years. Its muscular strength is so great, that it can leap 200 times its own length, and drag a weight 8 times heavier than itself

Acarus reduvius; the tick
„ ricinus; dog-tick
„ telarius; often hurtful to plants kept in hot-houses
„ scabiei. This is the insect which causes itching in the disease called the itch
„ lactis
„ muscorum
„ fungorum; and several others of this genus
Hydrachna globator
„ grossipes; and some others
Phalangium hirsutum
„ grossipes
„ opilio
Aranea diadema
„ redimita
„ montana
„ domestica
„ viatica
„ saccata
„ extensa
„ latens
Acarus senoculata
„ holosericea
Cancer pisum
„ longicornis
„ mænas
„ depurator
[1] „ pagurus; crab, or *parten*
„ araneus
„ horridus. This is rather a rare species
„ bernhardus
„ araneiformis
„ corrugatus
[1] „ gammarus; the lobster
„ squilla; the prawn
„ crangon; the shrimp
Cancer Norvegicus
„ pulex
„ locusta
„ atomos
„ stagnalis
„ phalangium. This is the Cancer scorpio of Stewart. I have found several of these near the Sands of Barrie; it is reckoned a rare species
„ platychelas of Pennant, a rare species: I also found one of this on the Sands of Barrie
Monoculus quadricornis
„ rubens
„ pulex
„ longispinus
„ simus; and several others of this genus
Oniscus asilus
„ entomon
„ œstrum
„ aquaticus
„ oceanicus
„ assimilis. This species is often to be found among the Fuci or dulse, when sold at the cross in Forfar
„ asellus
„ armadillo
Scolopendra electrica
„ forficata
Julus terrestris
„ complanatus
„ sabulosus
„ oniscoides; among stones on the hill of Finhaven

[1] Both these species are called in Angusshire by the name of *Firy taugs*, or *Meg wi' the mony feet.*

WORMS.

Of the Order *Intestina*, the following occur:

Ascaris. There are many of this genus to be found; they inhabit the intestines of every kind of animals

Scolex lophii. I have a specimen of this animal which was found in the fishing-frog

Strongylus. Of this genus there are two species; one of them found in the horse and the other in sheep

Echinorhynchus, and likewise the genera Cucullanus and the Tænia, are found in the intestines, and other parts of many animals, and often get their names from the parts or the peculiar animals they inhabit

Fasciola is a very numerous family: the Fasciola hepatica is found in the liver of oxen, swine, horses, and sheep, and is said to cause a dropsical swelling of the abdomen

Gordius aquaticus: in ditches

Lumbricus terrestris: earth-worm

" marinus; on the sandy shores

Planaria fusca

" lactea; both in the Lake of Rescobie

Hirudo sanguisuga

" vulgaris

" complanata. This species is found common in a spring called the South Running Well, near Forfar

" hyalina

" bi-oculata. These two latter I observed in the Loch of Lintrathen

" muricata; inhabits the sea

Of the Order *Mollusca*, we observe the following:

Limax ater; black slug

" succineus; red

" cinereus; great spotted

" agrestis; small grey

" flavus; amber ditto

Doris verrucosa. I have seen this not unfrequent on the coast. I have a specimen of it preserved

" papillosa. I have also a specimen of this

" argo. I have seen this species thrown ashore at the Sands of Barrie

Aphrodita aculeata; cast on the shore, not unfrequent

" squamata

" lepidota

Amphitrite auricoma. I have seen several of this on the shore

Nereis noctiluca. These animals illuminate the sea, with a brighter splendor than the glow-worm's

Nereis pelagica; not unfrequent; I have a specimen of this preserved
Nais serpentina; common in the small pools of water at the east end of the loch at Forfar, among the Lemna minor and trisulca
„ proboscidea; in marshes,—ponds and ditches near Forfar
Ascidia rustica; in the sea not unfrequent: I have a specimen of this preserved
„ mentula
Actinia rufa
„ crassicornis; and some others of this genus
Lernæa salmonea
„ asellina
„ pectoralis. I have a specimen of this preserved
Sepia media
„ loligo. I have seen this species often driven ashore near Montrose
Medusa cruciata
„ capillata
„ aurita
„ octopus. They are not unfrequent in the sea; the greatest quantity I ever observed of them was at the village of Achmithie, six miles east of Arbroath
Asterias papposa
„ lacertosa
„ rubens
„ sepositа; rare
„ glacialis. I observed what I take to be a non-descript species at Achmithie
Echinus spatagus
„ esculentus

Of the Order *Testacea*, we have the following:

Multivalves.

Chiton albus. I observed one of this species on the shore at the Sands of Barrie
„ marginatus
Lepas balanus
„ balanoides
„ anatifera
„ striata
Pholas dactylus
„ crispata

Bivalves.

Mya truncata
„ arenaria
„ margaritifera; common in Water of Esk
Solen vagina
„ siliqua
„ ensis
„ legumen
„ pellucidus
Tellina fragilis
„ planata
Tellina radiata
„ donacina
„ ferroensis
„ rhomboides
„ cornea
„ rivalis
„ carnaria
„ rugosa
Mactra stultorum
„ solida
„ lutraria

Univalves.

Cardium aculeatum
„ echinatum
„ edule. This is the common cockle
Venus gallina
„ islandica
„ exoleta
„ undata
Ostrea varia
„ opercularis
„ edulis. The shells of this are sometimes thrown on the shore
„ maxima; but rare
Anomia ephippium
„ cepa
„ squamula
Mytilus rugosus
„ barbatus
„ edulis; the common muscle
„ pellucidus
„ modiolus
„ cygneus
„ anatinus
„ discors; a rare species
Cypræa pediculus; at Lunan Bay
Buccinum lapillus
„ undatum
„ reticulatum
„ minutum
Strombus pes-pelecani. I observed this shell on the Sands of Barrie
Murex clathratus; it is rare with us
Trochus cinerarius
„ zizyphinus; but rare
Turbo neritoides
Turbo littorcus; *wilk*, or periwinkle
„ rudis
„ cimex; on the Back Sands at Montrose, not unfrequent
„ terebra
„ perversus
„ muscorum
„ fontinalis; White Mire, near Forfar
Helix striatula
„ planorbis
„ lapicida
„ arbustorum
„ aspera
„ ericetorum
„ turturum
„ virgata
„ rufuscens
„ nemoralis
„ stagnorum
„ stagnalis; in Crook water, but rare
„ palustris
„ putris
„ limosa
„ auricularia
Nerita glaucina
Patella vulgata
„ ungarica
„ lacustris
„ fluviatilis
„ pellucida
Sabella alveolata
„ lumbricalis
Dentalium entalis. I found this shell, with the animal in it, on the sand at Lunan Bay
Serpula spirorbis
„ triquetra
„ contortuplicata

I have observed a great number of minute shells, of different species, on the moist places on the Sands of Barrie, which would require a magnifier to distinguish them, but never had time sufficient to examine them.

APPENDIX G.

LETTERS OF GEORGE DON.

As in the case of John Mackay, who, like George Don, maintained a correspondence with Sir James Edward Smith, there are no letters in the Smith correspondence in the possession of the Linnean Society from George Don. Don's letters to Mr. N. J. Winch have been referred to several times, and by the kind permission of the President and Council of the Linnean Society, in whose care the Winch correspondence is, I am able to present here copies of these letters, which I do from the standpoint of "Le style est l'homme même." I would like to add that in their reproduction I have been greatly assisted by Mr. B. Daydon Jackson, Secretary of the Linnean Society, who has not only himself transcribed for me some of the MS., but has also collated and corrected the proofs. I make no apology for quoting here (with his consent) his comments, in a letter to me accompanying the collated sheets, for they tell of Don's workmanship as it appears in the letters and also convey his impression of Don after perusal of them—an impression which readers generally will share. He says:—"I have just completed the collation of Don's letters, and am sending them with this. There still are some words which I cannot make out, after long study of them, Don's letters are so badly formed—a, o, u are practically the same, and so on. The letter dated Feb. 18, 1810, is an especially bad specimen; you have seen it, and remember that he has closely packed both sides of a sheet of foolscap with names of plants and remarks, wherever he could find half an inch of blank paper. The task of copying was a hard one, hence the blunders that arose; I hope I have corrected all, but nothing short of a photo. could do justice to the writer. His letters show him eager and enthusiastic, clamorous for help; like all collectors, far from bashful in asking favours, but also unmethodical and careless to the last degree. He is constantly excusing his want of attention to Winch's requests by his having mislaid the last letter."

George Don to N. J. Winch.

Forfar, May 11th, 1802.

Sir,—I received your letter a few days ago, and shall be very glade to exchange plants and speciments—no one likes a faithfull correspondent more than I doe. You mention some good things that is to be found in your neighbourhood, although I have all them except Ribes petraeum and Bartsia Alpina, although I have found Bartsia about 50 miles from Forfar, but could not remove it to grow. But I should be obliged to you to pot and plant it and 2 of G[entiana] Verna and try to establish them in 2 pots as the only way, and save seeds of Thalictrum major and Cistus marifolius and speciments, as I have but a weak plant of Gentiana verna and Cistus marifolius. I should be obliged to you to send a catalogue of all the rare plants within your reach, I mean your botanical excursions, and not to forget the cryptogamous famely, as I think you could assist me in speciments of some of the English hypnoms that I have not found in Scotland, and if I remember I seed some speciments of Lichens that I suspect came from you. When I was on a visit to Mr. Mackay about Sept. last, a new one you had discovered, and imersus, both which I should be glad to have, or any other you may judge rare. But I shall see by your catalogue what is in your power to assist me with. I have laboured hard for this last winter and have made several new discoveries in that intricat part of the science, among which is a new hypnum. I call it in my herbarium fontenaloides, and another alpinum which Dr. Smith is to adopt my names for in his Flora Britanica, as he by letter informs me, and 3 or 4 new hypnoms which I have affixed no name to as yet. One of them I think of calling mimosiodes and another trichomonoides as they both belong to the first division, and 2 more I have not thought of names that would be applicable as yet, and a new bryum that comes nearest the Grimmia cribrosa of Hedweg, and a new Gymnostomon I call maritima from its growing near the sea, and a new Orthotrichum Dr. Smith is to call obtusifolium. I found this on the Bark of a willow tree in the Botanic Gardens while on a visit to our mutual friend Mr. J. Mackay who is no more. In calling back to my mind that worthy man excites painfull sensations in my breast and wound my feelings deeply. Besides this Orthotrichum obtusifolium I have 4 or 5 more I believe are non Descripts and I have sent them to Dr. Smith but have received no answer from him as yet, but I suppose from them and some other Cryptogama I have sent him, he will require some little time to determine some of them. I have also Discovered a new Spergula I call maxima and a new Carex that comes nearest limosa but wants the strong creeping roots that are so characteristic in limosa. Dr Smith declares it new to him also, and Stellaria scapigera of Wildenow, Dr. Smith informs me that neither he nor Wildenow knew its proper habitat, and Potamogeton hetrorophullum, Fl. sesilis and another one I have not

been able to Determine as yet. I have found a number of Dickson's new mosses also. I was the first finder of Convallaria verticillata, Carex pulla, Festuca calamaria having found them in 1789 and 90 and Eriophorum alpinum, and Juncus castaneus and the Spergula Sag[ina mariti]ma and Saxifraga rivularis, but giving information or speciments they took the libberty to Declare themselves the Discoverers which was ungenerous in some Degree. If I remember Thlaspi alpestre, and montana, and Hypochoris maculata, and Cypripedium calceolus and Serapas grandiflora, and ensifolia are found not far Dystant from you which is plants I want much and as I lived in Yorkshire half a year at Broadsworth near Doncaster where were found the rare plants Ophyrs apifera, and insectifera, and spiralis, and Orchis ustulata, and pyramidalis, all plants I want much, I shall be glad to hear from you soon and the catalogue as soon as convenient. If I am wrong in your address pray put me right—you seem to have forgot it.

I am, sir,

Yours humble servant,

(Sgd.) G. DON.

George Don to N. J. Winch.

Sir,—I have sent you a number of your Desiderata and I shall send you the rest or as many as I can furnish you with in the Autumn along with a collection of Cryptogamia. I would a sent you more cryptogamic speciments had I not been tyed Down to time for I am going a long Botanical excursion to the north in a part of the highlands that has not yet been Investigated by any scientific men so that I flatter myself with some new Discovery.—As you observe my neighbourhood is excellent for cryptogamia particularly musci and especially the Genus Bryum and a number of the Salix and by no means contemptible in ether Carex or any of the genera of cryptogames though it Does not abound with old Forrests as many parts of England do.

I will be obledged to you to save as many speciments and seeds and procure as many plants as possible you can by the Autumn or at least by the time I return and I shall writ you upon my return and I shall let you know what success I have met with in my excursions.

Believe me Dear sir your obedient and humble servt.

(Sgd.) G. DON.

Forfar June 29th 1802.

N.B.—The figuers is the number of plants I would wish of each sort thos with no figuer I only wish a good plant or 2 of a kind.

PLANTS.

Equisetum fluviatile+
4 Orchis pyramidalis+
6 „ ustulata+
6 Ophrys muscifera+
4 „ apifera+
2 Serapas longifolia+
4 Cypripedium calceolus+
Schoenus compressus+
4 Calomagrostis epigejos+
Potamogeton marinus+
6 Primula farinosa+
4 Hottonia palustris+
Ribes petraeum+
„ spicatum
Atriplex portulacoides
6 Gentiana verna+
Sium latifolium+
Œnanthe pimpinelloides+
Frankenia laevus
Euphorbia paralis
Rosa tomentosa+
„ villosa+
4 Dryas octopetala+
4 Cistus marifolius
Thalictrum majus
Statice lemonium+
4 Orobanche major
Trifolium hybridum
„ ochroleucum
Carduus acaulus
+Carex capillaris
„ muricata

I will be oblidged to you to send me speciments of those contained in this list and if to spair send 3 speciments of each sort. But those marked with a cross thus I have speciments of that will Do for my herbarium.

SEEDS.

Trifolium striatum+
„ glomeratum+
„ scabrum
„ maritimum
„ ochroleucum
Cripis biennis
Cichorium intybus+
Carduus eriophorus+
„ acaulus
Erigeron canadense
Senecio tenuifolius+
„ squalidus
+Centaurea calcitrapa
Matricaria maritima
Zannichellia palustris
Panicum viride
„ dactylon
Poa distans
+Rottbolia incurva
Amaranthus blitum
Potamogeton Densus
Ruppia maritima
Hottonia palustris
Anagallis tenella
Samolus Valerandi
Chenopodium olidum
„ hybridum
Atriplex littoralis
„ pedunculata
Beta maritima
Beta tenuissimum
Sison amomum
Pastinaca sativa
Smyrnium olusatrum
Pimpinella magna
Apium graveolens
Myosurus minimus
Frankenia Laevis
Rumex aureus
+Saxifraga trydactylites
Arenaria verna
Resida lutea
Euphorbia paraliis
Papaver hybridum
Cistus marifolius
Statice limonium
Lamium desctum
Melissa calamintha
Bartsia alpina
Antirrhinum minus

Antirrhinum spurium
+———— elatine
Lepadium didymum
Thlaspe alpestris
Sisymbrium terestre

Erysimum cheiranthoides
Brassica minosis [monensis?]
oleracea
Lathyrus hirsuta
picris echioides

SPECIMENTS WANTED.

Hypnum sciuroides+
If in fructification dendroides+
If in do. proliferum+
If in do. lutescens
If in do. sericeum
If in do. velutinum
cylindricum
Fucus subfuscus
varabilus [variabilis]
plicatus
lichenoides
mamillosus
loreus
natans
repens
Conferva spongiosa
gelatinosa
elongata
pennata
parasitica
Splachnum ovatum
" ampullaceum
Polytrichum aloides
" alpinum
Mnium heteromalum+
If in flower glaucum
pellucens
If in flower arcuatum
Bryum paludosum
If in fruct. laterale+
aestivum
Only if in fructification alpinum
fontinelis
antipyraticum

Lichen +albus
+jolithus
+atro-albus
calcareus
+immersus
muscorum
confluens
canescens

Lichen +coeruleo-nigrescens
+niger
+Baeomyces
+sphaerocephalus
+calvus
vernalis
concentricus
+punctatus
scruposus
+atro-cinereus
+Dicksoni
+tricolor
+cerinus
+floridus
+multifidus
cartilagineus
lanatus
torrefactus
Deustus
perlatus
+granulatus
+cristatus
+sinuatus
+fascicularis
+simplex
crenulatus
+crenularius
+subimbricatus
+carnosus
+lacustris
+frigidus
+exanthematicus
+quadricolor
+rimosus
+psora
gelidus
+laevigatus
+anincus
If in fruct. fragilis
papillaris
muscicola
exilis
saturninus

If in fruct. inclusus
haematomma
If in fructification send
Jungermannia furcata
pinguis
asplenioides
polyanthos
asplenifolia
platyphylla
ciliaris
Byssus aeruginosa
aurea
fulva
barbata
Merulus cornucopioides
membranaceus
Fistulina pectinata
Boletus nummularius
nigripes
substrictus
betulinus
medulla panis
suaveolens
cryptorium
labyrinthiformis
rubeolarius
sulphureus
Hydnum Barbajovis
Auricularia nicotiana
papyrina
If any of the pezizas will make speciments you may add any of them.
Nidularia campanulata
laevis
Clavaria phacorhiza
Lycoperdon epidendrum
Sphaeria mori
sanguinea
mammosa
fraxinea
Or any other you find in your neighbourhood.
You can add seeds of the following
Phalaris phleoides
Bromus madritensis
Euphorbia tithymaloides
Ranunculus muricatus
" arvensis
Vicea bengalensis
Medicago prostrata
Chrysanthemum Italicum
Centaurea galactites

I wish as many of the Cryptogames speciments as possible you can particularly Fucii and any of the fungia that will make speciments and particularly the genus lichen and if possible all those marked with a cross thus + as I have speciments of several of the others though some of them not good ones and wish to see what Difference is in those in your part of the country by those produced in our more northerly situation.

George Don to N. J. Winch.

Sir,—Pardon me for being so long in writing you for owing to my removal which I no doubt you have heard off is in a great measure the cawse of my long silence—— I shall send you the habitats of the plants sent and continue sending you the rest of your dissiderata as soon as I can fall in with your letter which owing to me being but a short time removed I am at a loss where to lay my hand on a many articles as yet. I shall also send you speciments of my new discovered plants and Cryptogamiae but it will be 2 week yet before I can yet begin to make them out as our hothouses is all to take threw hand [?] as non of the pots is turned as yet which owght to been done 6 weeks before—as it is but 2 week since I come to the

Edinburgh Botanic Garden—I will be oblidged to you to send the speciments and plants and seeds as soon as convenient and send them by sea Directed to me at the Edinr. Botanic Gardens Leath Walk with a line of information—and any of the cryptogamia you can spair I should be glad to have 2 or 3 of each as I intend cultivating all them I can in the Garden particularly muscii a number of which I have planted already ..... for from repeated tryals I have made myself wil not be dificult.

I am, Sir your humble servt.

(Sgd.) G. DON,

Botanic Gardens, Leath Walk.

Decr. 26th, 1802.

Mr. Nath. J. Winch.

[1][Answd. & Desiderata sent 29th Decr. 1802.]

G. Don to N. J. Winch.

Sir,—I received your letter and after that some specimens which I return you my herty thanks —— I would have answered yours in course but my youngest son was in a bad state of health for some time which ended in his dissolution that being the common tribute of nature—that so embarassed my feelings that I found myself very unfit for some time to pursue my favourite pursuit of Botany. — I herewith enclose you a specimen of Alopecurus alpinus which I found on wet rocks on a high mountain in Aberdeenshire called Loch.na.gare. I would be oblidged to you to send me the names of the specimens I sent you before and I will send you the habitats of them for I have mislayed your letter where I had them marked and therefore have forgot what I sent you I should be much oblidged to you for any other specimens of Lichins and as soon as our Class is over I shall send you some in return but at this time I am so throng that it is impossible for me to do anything in that at present.

I am sir your humble servt.

(Sgd.) G. DON.

Botanic Gardens L. Walk, Edinb.,

June 7th, 1803.

G. Don to N. J. Winch.

[1][Recd. in Jany. 1804.]

Dear Sir,—I should begin all my letters with confession of sins but it will be better to amend my ways—I have been much engaged

[1] In Mr. Winch's writing.

in aranging my cryptogame specimens this winter as I have never got that done before which you may see is a very unconvenient thing to lay my hand on any thing I want however I have got throw a many of them and I will have your collection completed as soon as possible — I will be much oblidged to you for specimens of the Hypnum crenulatum and your Lichin glaber or lævus but I have mislayed your letter so cannot lay my hand upon it and any of your other Cryptogamae specimens that is to spare — the following is the habitats of the Cardamine hastulata the Mountain called Ben ibllech in the Isle of Skye, Isle of Rum else where I never observed it — Stellaria scapigera on mountain to the North of a Lake called Loch Errech in Badanoch and by the side of a Rivulet upon the side of a mountain by the side of a Lake called Loch nevis in the District of Knadert in Invernessshire but in both places truly rare — I will be oblidged to you to send me a specimen of all you Discovered in your last years excurtion as I cannot find your letter last sent and any of them I may have the carriage can be no object if you have them to spaire as on the other side is a list of plants and mosses and Lichens I want which is as follows. viz:—

A list of plants wanted for the Bot. Gardens viz.—

Zannichellia palustris
+Orchis pyramidalis
+ ustulata
+Ophrys nidus-avis
cordata
+ muscifera
+ apifera
+Malaxis paludosa
+Serapias longifolia
+Cypripedium calceolus
+Schoenus compressus
+Panicum viride
+Specimens only, dactylon
Amaranthus blitum
+Galium spurium
Ruppia maritima
+Hottonea palustris
Ribus petraeum
spicatum
+Atriplex pedunculata
+Beta maritima
+Sison amomum
+Smyrnium olusatrum
Drosera longifolia
+Ornithogalum luteum
Carex pedata
+Euphorbia paralias
+Rosa tomentosa

Geum rivale
2 and 3 var.
Thalictrum major
Bartsia alpina
+Antirrhinum spurium
+Orobanche major
+ officinale
+Thlaspi alpestris
+Brassica muralis
+Lathyrus hirsutus
+Trifolium hybridum
+ glomeratum
+ scabrum
+ strictum
+Picris echioides
+Crepis biennis
+Senecio tenuifolia
+Matricaria maritima
+Centaurea calcitrapa
+Equisetum fluviiatile.

I wish specimens of the following if wild ones as I can easily get garden ones viz.—

Veronica montana
Panicum dactylon
Calamagrostis epigejos
Rotboelia incurvata
Primula farinosa

Campanula hybrida
Bupleurum tenuissimum
Caucalis daucoides
Sium latifolium
Statice limonium
Linum perenne
+Myosurus minimus
+Narcissus biflora
+Frankenia laevis
+Rumex aurens
+Saponaria officinae
+Dianthus armeria
+Rubus chamaemorus
+Dryus octopetala
+Papaver hybridum
Cistus marifolia
Helleborus viridis
Melissa calamintha
Bartsia alpina
Antirrhinum spirium
minus
elatine
orontium
Isatis tinctoria
Lepidium didymum
Brassica oleracea
Lathyrus hirsutus
aphaca
Trifolium ochroleucum
maritimum
strictum
Hypericum montanum
Carduus acaulis
Erigeron canadensis

And those marked thus + I wish specimens of if wild and some of them I wish to compare with others I have collected in Scotland and in the South of England.

Plants and specimens (continued)—

+Phalaris paradoxa
+Bromus madritensis
+Euphorbia tithymaloides
+Vicia berigalensis
+Medicago pratensis
+Chrysanthemum italicum
+Centaurea galactites.

The following is specimens of the cryptogama class which I wish much for in order to compare with some of mine and several of your lichins I have not specimens of.

Those marked thus + you need not send unless in fructification. I wish the Lichens much to compare with my own ones and where any of mine differs in the smallest degree from yours I shall send you a specimen of them in your collection.

Lichen albus
Jolithos
atro-albus
calcareus
immersus
sanguinarius
muscorum
confluens
canescens
niger
Oederi
geographicus
flavo-virescens
sepincola [?]
Baeomyces
sphaerocarpus

Lichen calvus
vernalis
concentricus
paralus
punctatus
scruposus
atrocinerus
Dicksoni
pezizoides
tricolor
tartareus
cerinus
upsaliensis
luridus
multifidus
radiatus

Lichen carnosus
lanatus
+glaucus
+Islandicus
+pulmonarius
+furfuraceus
+glomuliferus
+caperatus
+scrobiculatus
torrefactus
deusta
polyrhizos
proboscideus
polyphyllus
omphaleus
perlatus
orostheus
resupinatus
+tessellatus
tremella
granulatus
nigrescens
cristatus
incurvatus
fascicularis
simplex
crenulatus
exanthematicus
subimbricatus
canescens
lacustris
hypnorum
quadricolor
rimosus
psora
gilidus
leucopheus
caeruleo-nigrescens
carnosus
rappilosus
muscicola
exilis
saturninus
inclusus
acarii
haematoma
Splachnum ampullaceum
ovatum
Mnium heteromalum

Mnium +glaucum
pallacens [?]
+arcuatum
+proliferum
B paludosum
+tortuosum
Fontinalis +antipyretica
+alpina
Hypnum crenulatum
sciuroides
+crispum
+viticulosum
+crista-castrensis
+dendroides
+alopecuroides
+proliferum
+parietinum
+palustre
+cylindricum
+riparium
sericeum
serpens
velutinum
Jungermannia +furcata
+pinguis
+asplenioides
polyanthos
platyphylla
ciliaris
Fucus natans
repens
esculentus
sanguineus
mammilosus
lichenoides
plicatus
subfuscus
variabilis
Conferva spongiosa
gelatinosa
elongata
pennata
parasitica
Byssus aruginosa
fulva
barbata
Merulius cornucopioides
membranaceus
Agaricus ostreatus

Agaricus planus
flabelliformis
reniformis
betulinus
glavicans
Fistulina pectinata
Boletus all you can
Hydnum barbajovis
Auricularia nicotiana
papyrina
Piziza punctata
coccinea
epidendra
inflexa
navicula
cochleato
Piziza polymorpha
Nidularia campanulata
laevis
Clavaria phacorhiza
spathula
ophioglossoides
Lycoperdon stellatum
innatum
epidendron
Sphaeria sanguinea
mori
mammosa
fraxinea
and any others you have to spare.

Sir,—You wished to know what is become of the late Mr. Mackay's Herbarium it is in the hand of his brother but I am certain he does not mean to part with it I believe it consists mostly in Foreign plants and what plants he collected the two excurtions he had throw the highlands but I am certain it does not abound in neither lichens nor mosses as he had but little knowledge of that part of botany for in the year 1791 when I first became acquainted with him he knew very little of native or foreign plants so that the time he had to study would not admit of his having a thorow knowledge of every part of Botany althow he might be allowed to have been a very asidious young man—but I expect to see throw it soon an then I shall give you an impartial account—when you have any specimens of mosses or lichens of such as are plantifully about Newcastle I would be oblidged to you for a few of each as I have several applications for some from some of my correspondents which I find I will be unable to supply them with and as I am getting in return such as do not grow plentifully in our Neighbourhood it may be in my pour to send you a part of any I have in return—you wish to know if I have made any new discoverys in my last excurtion the snow was on the high mountains by the time I got 40 miles from Edinbr. so that I was not so fortunate as I could a wished however I find I have the Dicranium varians of Swartz quite new to Britain and also I found the Erigeron alpinum near Perth and also the Linnaea Borealis quite in the lowlands a place one would have little thought of finding them I have also a new Hypnum which I found in 1802 which Dr Smith writes me he has named after me it is somewhat like denticulatum but at same time very Different.

I am yours truly,

(Sgd.) G. DON.[1]

[1] Another untidy letter; the thread is broken and resumed all over the pages. Much of the mis-spelling is lost in transcription, because the writing at times is so hard to read that the letters cannot be distinguished.—*B. D. J.*

P. S. Could you inform me the price of Dicksons Fascicles of Dryed plants the price of each.

G. Don to N. J. Winch.

Sir,—I enclose you a specimen of the Encalypta alpina which I discovered on rocks on the very summit of Ben Lawers in Octr. 1804 I have never found it anywhere else and but sparingly there. I send you this in order to show you I have not forgot you altogether your last letter I have unfortunately mislayed but you can write me your disiderata and where that genus is extensive in specis write me your wants of one famaly at a time and I shall be lickly to send you them not long after I recieve your order and where the genes is not extensive such as Splachnum, Sphagnum &c. you can send 3 or 4 at once—I will be much oblidged to you for specimens of the Hypnums crenulatum—fluitans—alpinum, palustre —cylindricum—riparium—dendroides if in fructification.

Splachnum ovatum & ampullaceum. Neckera viticulosum if in fruct. Dicranum interruptum—sciuroides. Grimmia pusilla or any thing else you may judge rare where you can preserve specimens. I should like specimens for my Herbarium and where you cannot procure so many I beg you will send me what you can with mislaying your last letter I cannot remember what you can furnish me with. I wish much for a plant and specimen of the Scheuchzeria palustris and a plantago you have found. I some time ago sent you my Desiderata of Lichens any of which I will thank you for. I have found near Edinr. lately the Phascum stoloniferum or serratum but which I cannot determine I think them both one. I am going a short botanical excurtion but will be home soon.

N.B. I have found the Valeriana pyrenaica in two other habitats within this last year I have in consequence given it in my 4 Fasciculæ.

I am Sir your most obedt.

(Sgd.) G. DON.

I wish much for a few of each kind of the Mosses.

Royal Botanic Garden, Edinr.
Octr. 15. 1805.

Royal Botanic Garden,
Edinr.
Decr., 3, 1805.

Sir,—In looking over my specimens I have found out your Disiderata last sent about 4 days ago and have lost no time in forwarding what nature specimens I have in my possession of your Disiderata which is as follows—viz.

Veronica fructiculosa
Campanula rapunculoides
Orhys corallorhiza
Hieracium alpinum
Rosa involuta
Brassica campestris
Grimmia nuda
Donniana
Grimmia Schistii
Symphytum tuberosum
Linnaea borealis
Erigeron alpinum of Dicks.
Polypodium dentatum
Ajuga alpina
Hypnum Donnianum

I have a prospect of getting specimens of the Ajuga pyramidalis for my Fasciculus next summer and I am not sure but I may have a specimen of Gentiana nivalis but I have never found the Arbutus alpina in flower nor have I ever seen the Cardamine bellidifolia in Scotland. I hope also to be able to procure you the Pyrola uniflora to my Desiderata I hope you will add Byrum nigrescens and Bartrammia crispa Shoenus monoecius and Grimmia pusilla, as your not satisfyed with the last being distinct from G. calcareum where it is possible to send me specimens for my Herbarium I beg you will have it in view and where enough cannot be obtained I beg you will let me have as many as you can which will allways be a step to that object I will be glade to hear from you soon and believe me dear sir yours

most obedt and humble servt.

(Sgd.) G. DON.

P.S. I have sent them per Newcastle Waggon any other specimens you may want for your Herbarium you will have the goodness to write me. I subjoin a list of what new plants are published in my Herb. which I can let you have specimens of—viz:—

Valeriana pyrenaica
Juncus supinus
Myagrum paniculatum
Gallium spurium
Lichen ——— [illegible and blotted].

G. Don to N. J. Winch.

Forfar, December 6th, 1807.

Sir,—Some time ago I Recieved your two volumes of the Botanists guide for which I return you my most gratefull thanks they contain a number of rare plants and especially the Class Cryptogamia the the [*sic*] method you have adopted in the Lichens I have reason to believe will become general your work is a just specimens of your zeal and ardent pursuit of Botany—since my return to Forfar I have made several excursions and found a good many new plants and I am anxious in every opportunity of rendering my colection as numerous as formerly in consequence of which I have sent you my disederata taken from the Botanists guide. Plants or seeds of as many as you can will much oblidge me—your disederata

I am paying particular attention to but it contains several plants doubtfull natives which have not been found for many years I shall send you all that I have native plants of. I have cultivated specimens of nearly all the remainder.

++Schoenus monoicus
++Scirpus multicaulis
Panicum sanguinale
Agrostis spica venti
+Poa procumbens
Cynosurus echinatus
Bromus multiflorus
secalinus
arvensis
Arund. epigejos
++Hordeum maritimum
Triticum loliaceum
Ruppia maritima
Sagina erecta
++Anchusa officinalis
++Primula farinosa fl. albo or any other variety
Hottonia palustris
Anagallis arvensis
+Verbascum nigrum
Chironia littoralis
pulchella
centaurium fl. albo
No. 221 B. G.
Ribes spicatum
petraeum
Chenopodium urbicum
glaucum
++Gentiana verna
Several plants of this if convenient.
++Bupleurum tenuissimum
Daucus maritimus
Sium nodiflorum
Sison amomum
++Statice limonium
++Drosera anglica
++ longifolia
++Juncus acutus
++ maritimus
Rumex acutus
maritimus
palustris
++Pyrola media
++Scleranthus perennis

+Scheuchzeria palustris
++Cerastium pumilum
++Reseda lutea
++Euphorbia paralia
Rosa tomentosa
nova sp.
Rubus crylifolius
Potentilla aurea
+Cistus marifolius
Thalictrum majus
Thymus calamintha
Bartsia alpina seeds.
Antirrhinum spurium
++Orobanches all species.
Lepidium ruderale
++Thlaspi alpestre
++Cochlearia anglica
Sisymbrium sylvestre
++ irio
Brassica oleracea
Lathyrus hirsutus
Ervum tetraspermum
++Trifolium maritimum
subterraneum
scabrum
++ glomeratum
striatum
Picris echioides
++ hieracioides
++Hedypnois hirtus
++Crepis foetida
++ biennis
Senecio tenuifolius
++Anthemis maritima
++Centaurea calcitrapa
++Orchis pyramidalis
++ ustulata
++Ophrys muscifera
++ apifera
++Malaxis paludosa
++Cypripedium calceolus
Carex divulsa
++ extensa
acuta
++Sagittaria sagittifolia

Salix forbyana
rubra
croweana
mas et fem.
russelliana
bicolor
fusca
rosmarinifolia
aquatica
oloefolia
mollisima
decipiens
++Peucedanum silaus
++Atriplex portulacoides
Equisetum fluviatile
Aspidium lobatum
Primula elatior
+Hypericum maculatum
++Tamus communis
Juncus No. 221.
Delphinium consolida
Alopecurus bulbosus
Bromus spiculitenuata
Cuscuta epithymum
Limosella aquatica
Sisymbrium amphibium
+Brassica orientalis
+Erodium maritimum
Artemisia gallica
maritima
Atriplex pedunculata
Salix radicans
Chlora perfoliata

Those that are marked with one cross I have plants of. I only wants a few native specimens of each. Those marked with two crosses I wish a few plants of each particularly those that grow in your vicinity.

I am convinced you can only send me a small quantity at present I want as many as you can conveniently procure in the Spring and those that are anual I will thank you to collect when the season arrives some of the anuals however will remove very well in spring such for instance as the Centaurea calcitrapa it will be requisite to cut off the leaves when they are picked and pack them among Sphagnums they can be sent by a ship to Dundee—Directed to me at the Botanic Garden, Forfar.

Could you informe me how to direct to a Mr. Wilkinson a Botanist in or near Sunderland.

N.B. At some future period I shall be under the necessity of troubling you for some specimens of Cryptogamia but I am convinced the demand at present is sufficient.

Where plants cannot be procured of the Salix and Ribes Cuttings will do very well in so doing you will greatly oblidge.

Your Humble Servant.

(Sgd.) G. DON.

P.S. I wish specimens of them as well as plants I have a specimen but I should wish for 2 or 3 specimens in order to complete some collectors of specimens

Yours as above

(Sgd) G. DON.

G. Don to N. J. Winch.

Forfar, Feb. 18, 1810.

Sir, —I received your letter in due time and I shall lose no time in sending you part of your Disiderata with several valuable and interesting additions they will leave Dundee by the first ship for Newcastle after the 24 instant—I am much oblidged to you for your kindness in saving specimens for my Herbarium as I am now imployed in finishing my 7 and 8 numbers after a stand of nearly 4 years for if I had not got Subscribers to enable me to have carried it on I could a predicted my Discoverys would a have been very limited in future but although my subscribers are not numerous yet I flatter myself they are respectable and likely to continue—and on my part shall exert every endeavour to make them interesting—if I remember right I have sent you the new plants which I have given in my 7 and 8 numbers which are Campanula persicifolia, Sagina maritima, nova species, Potentilla opaca of Linn Rotboella filiformis—I am to send you a package for Mr. Harriman which I beg you will take the trouble of forwarding along with yours if you would have the goodness to send the specimens you have collected for me and I will get some of them to help my 9 and 10 numbers—I formerly sent you a long list of Desiderata particularly of plants of my Garden I beg you will add Rosa collina and your scaberosa. I flatter myself I have the latter but wish to see your plant as also Rosa tomentosa and villosa and Ribes spicatum I have found the Ribes petraeum or spicatum in great plenty in my neighbourhood—I am very anxious to encress my collection of Growing plants as I have several Classes arranged and of consequence a number of blanks which I am making applications to all quarters to get filled up. I wish much for seeds of Bartsia alpina and I should like to have a few plants of Gentiana verna and and if possible Cypripedium calceolus, Tamus communis and if you can observe one variety among them would like them also and if you can send me Primula farinosa, Schoenus monoicus with white flowers which I understand is not uncommon——[illegible] and——[illegible] and Rubus caesius but I do not want Rubus corylifolius as I have got it—Have you ever seen Arenaria verna with double flowers if you have got it pray send me it. I observed it among specimens collected in Derbyshire about 14 years ago. Is it possible to send me Anthemis maritima I have never seen it. I likeways wish much for Juncus acutus and maritimus and your new species and Crepis foetida and Hyderserus hirta can you send me plants or seeds of any of those you collected in Surry, did you not fall in with the following mosses Trichostomum flexifolium, Tortula imberbis, Grimmia starkeana—lanceolata, Dicranum bipartitum—cylindricum, Trichostomum obtusum, Tortula barbata,—aristata, Hypnum medium—inundatum—tenellum as they inhabit the south. I want specimens of all those even for my own private [?] herbarium. I must leave you to collect such specimens as you can with con-

venience get of those which will best answer you are a perfect judge for instance Cistus marifolius, Schoenus monoicus and Pyrola medea as I have specimens of all the other British species and would give the whole in a grop together. I would like also a few specimens of Carex extensa as also plants and plants of Carex acuta both Orobanches plants and specimens and a few specimens of Carex digitata. I have already a few of both C. digitata and extensa. I would likeways be much oblidged to you for specimens of all the Opegraphas as I have got a few specimens of the Opegrapha Lyelli I beieve as many as will answer saved by C. Lyell Esq., New Forrest I would give as many of them togither as possible. I am quite bewildered among them since they were made a separate famely having neither Books nor specimens to study them by. I shall add a list of all the mosses which I want specimens of for my Herbarium and where you cannot send me enough send me what you can in order to compair with some I have which I am not certain of and there is some of them I der say I have non of—they are as follows viz.—

MY DESIDERATA.

Tetraphis pellucida
Grimmia Dicksoni
+hommamala
verticillata
Dicranum undulatum
+ interruptum
fulvellum
rigidulum
+ovale
pulvinatum var B.
squarrosum
taxifolium
flexuosum
+cerviculatum
polyphyllum
Trichostomum +lineare
fontinaloides
+trifareum
Tortula rigida
cunifolia
+barbata
aristata
brevifolia
Orthotrichum affine
pumelum
rivulare
+nudum
+pulchellum
Neckera heteromalla
Hypnum +polyanthos
myosuroides
+crenulatum
+serrulatum
Teesdalii
+riparium
praelongum B
+stokesii
+stramineum
+confertum
murale

I have some specimens of most of the Hypnums but not sufficient to answer my purpose those marked thus + I want much even altho you cannot procure specimens enough for my purpose.

Hypnum velutinum
intricatum
tenellum
implexum
illecebrum
Hypnum Schreberi if in fruit and
fluitans
rugosum
+aduncum

Hypnum +palustre
fluviatile
filicinum
commutatum
+abbreviatum
+chrysophyllum
scorpioides
+nigro-viride
+alpinum
+recognitum
+attenuatum
+polymorphum
Fontinalis capillaca
squamosa
Bartramia crispa
ithyphylla
arcuata
I have plenty spec. of
B. Halleriana
Mnium +androgynum
Bryum nutans
trichodes
+carneum
+capillare
+annotinum
+nigricans
ventricosum
roseum
lanceolatum
cuspidatum
+aristatum
Poletrichum juniperinum
+aloides
nanum
+pumilum
Sphagnum squarrosum
Gymnostomum No. 109
microstomum
Phascum cervicollum
patens
Phascum bryoides
muticum
Schreberianum
crispum
Jungermannia scalaris

Jungermannia qunquedentata
bidentata
nemorosa
If in flower bicuspidata
reptans
If in flower platyphylla
curvifolia
If in flower tomentella
divaricata
minutissima
All the Leprarias, but botryoides and alba.
All the Pulveraria both species of Variolaria.
Lecidea, all but the following viz :—
parasema
petraea
atrovirens
silaceus
cupularis
luteola
incana
icmadophylla
hamatomma
var B.
vernalis
aurantiaca
calva
crenulata
orosthea
atrorufa
lurida
vesicularis
These are what I do not want.
Send
Caliceum claviculare
Gyrophora cylindrica
erosa
Send me all your Variolaria
Send me
Endocarpum hedwigia
smaragdulum
Weberi

MY DESIDERATA continued.

Thelotrema pertusum
lepadinum
hymeneum
Isidium Westringii
phymatodes
Urciolaria cinerea

Urciolaria calcarea
fimbriata
exanthematica
bryophila
epulotica
cyrtaspis
Parmelia excisa
pinicola
sophodes
ostracadermis
coarctata
amylacea
impolita
glaucoma
diacaspis
Turneri
dispersa
frustulosa
cerina
stillicidiorum
chloroleucum
vitellina
varia
squamulosa
crassa
lepidota
spongiosa
brunnea
epigaea
saxicola
elegans
miniata
murorum
leptalea
virella
recurva
aipolia
affinis
scortea
saturnina
lacera
tuniformis
flaccida
furva
cristata
Scotina
and var. sinuata
melaina
muscicola
Parmelia scopulorum
siliquosa
pollinaria
polymorpha
Sticta limbata
Peltidia rufescens
polydactyla
horizontalis
Citraria juniperina
Citraria var. prunastri
Cornicularia muricata
opuntia
viridis
lanata
aculeata
Usnea florida
Baeomyces placophyllus
caspititius [caes]
digitatus
cornucopioides
diformis
bellidiflorus
cervicornis
fimbriatus
cenoteus
alcicornis
spinosus
Any of tbe Tremella that will preserve
Fucus ruscifolius
hypoglossum
membranifolius
natans
tamarascifolius
bifidus
edulis
phyllitis
ciliatus
laceratus
laciniatus
confervoides
lycopodioides
purpurascens
Ulva asparagoides
clavellosus
articulatus
opuntia
viridis
limosa

Ulva laciniata
lanceolata
lactina
defracta
elminthoides
intestinalis
fistulosa
plumosa
Conferva rivularis
nitida
fontinalis
confervicola
Conferva limosa
decorticans
lucens
sordida
setacea
amphibia
littoralis
aeruginosa
corniculata
scoparia
flexuosa

I would need specimens of all your Conferva as I am not well acquainted with that family.

As also all your
Byssus
And all your
Boletus that will save for specimens
As also all your
Fistulinas
Hydnum auriscalpium
barbajovis
All your Helvellas that you can save
As also Peziza and
Auricularia and Clavaria
And Sphaeria and Reticularia
Trichia and the genus Mucus [Mucor?]
Xylostroma gigantea
—— cordis
All your Rhizomorpha and . . . . [illegible]
Variolaria faginea

You will see by this list that I am greatly at a loss with the lichens for although I know the most of Witherings yet from the Great improvements and additions and alterations I am in a manner bewildered among them having neither specimens nor books to assist me. I have little doubt I have a many of those I am asking from you but I would be oblidged to you for 3 or 4 specimens of each sort as many of them as you can and specimens for Herb. Brit. of such as will answer I mean the rarer species you can conveniently and if you could send me them as soon as you can a . . . . . [seal here] making some excurtions early in the summer and that wa . . . [seal here] . . . e to collect not only them but new ones.

and if possible plants of Pyrola medea I have in cultivation all the the other british species. I have seeds of Galium tricorne and spurium, seeds of Chironia pulchella and littoralis and Centaurea fl. albo, Hottonia palustris, Chenopodium glaucus. Atriplex pedunculata, Saxifraga tridactyla and Elymus europeus, Reseda lutea, Plants of Orchis ustulata, pyramidalis, Malaxis paludosa and specimens as also apifera and muscifera and specimens.

If you could send any of my Desiderata of growing plants this spring I mean such as one in your neighbourhood although it were

only one would be a great acquisition to my collection—I have discovered several new mosses and shall send you some in course.

I am Dear Sir your humble
Servt.
(Sd) G. DON.

G. Don to N. J. Winch.

Botanic Garden, Forfar,
Apr. 19, 1812.

Dear Sir,—I received a letter a few days ago by post from you and to Day your Traveller left me another but he was so short time in the place that it was impossible for me to send any thing with him owing to the confused state of my herbarium, but I have a complete Herbarium of all the British plants to make up for a gentleman and the Books is nearly ready to begin to—I expect them from the stationer in 2 or 3 daystime so that I will have occasion to find all my Discoverys and other rare plants—other ways it would a have taken me 3 weeks to a have found out the few contained in your Desiderata—I do not mean to charge you money but you will have the goodness to send me the speciments you mentioned you had collected when in the south of England and I gave you a long Disiderata of Living plants some time ago which I will thank you to send me what you can of my Disiderata among which I beg you will send me the Juncus maritimus and acutus and a new Discovery as also Gentiana verna—Cypripedium Calceolus Schoenus monoicus—and I have all Anthemis maritima and Ribes spicata and Rosa collina—Atriplex portulacoides Serapias grandiflora and palustris pyrola media—Anchusa officinalis picris heracioides Carex depauperata—acuta Schoenus compressus mariscus nigricans Scirpus multicaulis Panicum sanguinale seeds Dactylon Cynosurus echinatus seeds and specimens Hordeum maritimum seeds and specimens Galium tricorne seeds and specimens Sagina erecta seeds and specimens Primula farinosa flore albo Hottonia palustris Chironia pulchella seeds Samolus Valerandi Chenopodium glaucum seeds and specimens Bupleurum tenuissimum Peucedanum silaus Sium nodiflorum Statice limonium Drosera anglica—longifolia Reseda lutea Euphorbia paralias Rosa tomentosa Thymus calamintha Bartsia alpina seeds Antirrhinum spurium seeds and specimens Orobanches all both plants and specimens Thlaspi alpestre Cochlearia anglica Sysimbrium Irio Lathyrus hirsutus seeds Eryum tetraspermum seeds Picris echioides Crepis foetida—biennis Orchis ustulata and specimens—pyramidalis and sp. Ophrys apifera and muscifera Sagittaria sagittifolia Tamus communis Atriplex pedunculata Aspidium lobatum Alopecurus bulbosus Cuscuta epithymum Sysimbrium amphibium Artemisia gallica specimens of the following mosses Bryum nigricans Orthotrichum pulchellum Dicranum interruptum corniculatum Tetraphis pellucida Grimmia Dicksoni—hommomalea Trichostomum fascicularis Tortula falax—cuneifolia—barbata—aristata Hypnum poly-

anthos nigro-viride—crenulatum—serrulatum—Teesdalii—riparium — Stokesii — stramineum — confertum — tenellum — intricatum — illecebrum—alpinum—abreviatum—chrysophyllum Mnium androgynum Bryum an [. . . seal here . . .]—ventricosum—Polytrichum juniperinum [. . . seal here . . .] aristatum — all your rare Phascum Bry[um,] Hypnum polymorphum, Parmelia d [. . . seal here . . .] lepidota — elegans—leptalea — furva — tereformis — spongiosa — stillicidiorum — chloroleucus — frustulosa — lacera — sageni [?] amylacea—sophodes—prunosa—urceolaria—cyrtaspis—bryophylla ?—epulotica—exthanthematica Verrucaria alboatra [?]—acrotella — spongiosa — nitida — geminata — thelostoma, Lecidia carnosa—luteo-alba — rupestris — calva—Jangermannia quadricolor — hypnophila — atroalba — athrocarpa — miscellus some of your Oregraphas Baeomyces caespititium and as many of your Sphaerias and Conferva and Clavaria as you can my Desiderata is taken from your Botanists guide and any of them that you can conveniently fall in with in plenty send me a good many specimens I have done nothing in my herbarium for some time past but means to commence directly and have I 3 reams of paper in the stationers for that purpose.

I am yours truly,

(Sd.) G. DON.

I will thank you to send me what of the growing plants of my disiderata you can as the season is now arrived. G. D.

The following letter to Mr. Sowerby is now in the British Museum, Cromwell Road, and is reproduced here by permission of the Keeper of the Botanical Department. It shows that Don appreciated the importance for botanical purposes of the difference between cultivated and native specimens, and that he endeavoured when contributing to the "English Flora" to prevent misapprehension on the part of its authors as to the source of the specimens he sent to them :—

George Don to Mr. Sowerby.

Forfar May 22, 1709.

Mr. Sowerby

Sir,—I have sent you a few plants as I understood that the speciments that is Dryed will not Answer Drawing. I shail send up Every 2 weeks through the summer if they will answer you a few as they Come into flower as I sent you up at a former piored native speciments. You will find that owing to my soil and situation that they Differ very little from the native ones. Yours

GEORGE DON.

N.B. When I have not sent before native speciments I shall send in course alonge with the green speciments native ones at the same time. G. Don.

[Address on the cover] Mr. Sowerby, No. 2 Mead Place, Lambeth, London.

POSTSCRIPT.

The foregoing sheets had gone to press when Miss M'Nab, with whom I was in communication regarding incidents in the life of her grandfather, William M'Nab, and of her father, James M'Nab, both former chiefs of the Garden staff, brought to my notice some correspondence that had been in the possession of her father between Dr. Neill and George Don, the son of the Forfar Botanist. The letters, with which is preserved the manuscript of Dr. Neill's biographical notice of George Don (No. 19 of the bibliographical list on page 91 of these "Notes"), show us Dr. Neill at the work of preparing this notice, and add to the information conveyed in Mr. Druce's Memoir. By the kind permission of Miss M'Nab I am enabled to reproduce them here:—

Dr. Neill to George Don (son of the Forfar Botanist).[1]

Geo. Don, Esq., 44 Bedford Place, Kensington.

Edin^{r}, 1st Feb. 1848.

Dear George,—I long to hear it goes well with you and your brothers since I parted with you in the end of August, already nearly half a year ago. I had a letter and some seeds from Patrick since he went to Tooting nurseries, and wrote an apology for not calling for him. I hope you are trying to find a good situation for him. Are James and Charles still in the same situations?

Mr. Gardiner's Flora of Forfarshire came to me the other day; and I am mortified to find the author so much in the dark respecting your Father's history. For example: he says, Mr. Don served an apprenticeship to a *watchmaker* in *Forfar*; whereas it was a clockmaker in Dunblane. He tells us that at Glasgow he became assistant to the Professor of Botany there;—but he never did so; it was your brother David who became assistant at the lectures in Glasgow. He alleges that from Glasgow Mr. Don went to Edinburgh, where Messrs. Dickson introduced him to Sir J. E. Smith &c.; whereas, he went to Forfar from Glasgow, and took a long lease from Gray of Carse of Dovecot-hill, and it was Mr. John

[1] The manuscript of this, in Dr. Neill's writing, is a draft of the letter and unsigned.

Mackay (not Dickson & Co.) who made him known to Sir J. E. Smith. Brodie of Brodie recommended Mr. Don to Dr. Rutherford, and he then sub-let Dovecot-hill, and removed to the Botanic Garden at Edin^{r}. Here he spent 4 or 5 years, latterly studying medicine and surgery; and then returned to Forfar, practised as a country doctor, renovated his botanical collection of living plants—and visited Clova Mountains, adding several new plants to his former discoveries, and here he died.

Could you assist my memory as to some dates and places? For instance. 1. Where was Mr. Don born and what was your grandfather? 2. Can you fix in what year it was that I first visited the garden at Forfar?—there were only three children then, yourself, David, and a little sickly sister.[1] 3. Do you recollect in what year the family came to Edinburgh?[2] you were a stout chap—David a little boy, and also James. Patrick and Charles were born in Leith Walk. 4. Do you recollect in what year Mr. Don died and in what month Mr. Brown and I visited Dovehill? 5. Could you point out the spot in Forfar Churchyard where your father was buried? My opinion is that British botanists ought to mark the spot by a simple but massy and enduring monument, and I may add that to my knowledge several are anxious to have an opportunity of testifying their admiration of his zeal and success as a practical botanist, and their deep regret for aspersion cast on his memory, regarding the reality of his discovery of Lychnis alpina, Sonchus cœruleus, &c. now so thoroughly wiped away. Where, it might have been asked, could Mr. Don obtain the seed of Lychnis alpina? It has never been known to produce seed in cultivation. 6. Can you mention other plants, the reality of which was sneered at by some English botanists? and can you state what are the plants mentioned by your Father, and not yet *re*-discovered by searching botanists: I recalled Potentilla tridentata and Hierochloe borealis.

Hierochloe borealis is called by Sir W^{m}. Jac. Hooker a "valuable discovery by the late acute Mr. G. Don"; but is now denied. Potentilla tridentata is in the same predicament: but will yet be re-discovered.

Be so good as write me fully on all these points.

Mr. George Don (son of the Forfar Botanist) to Dr. Neill.

44 Bedford Place, Kensington,
Feby. 28 1848.

My dear Sir,—I intended to have written to you long before this, but something always came in the way to prevent it. James and Charles are still in their old situations, the latter got married in Sept^{r} or Oct^{r} last, but I have not yet seen his wife. As to

[1] See pages 62, 63 of the Memoir in these "Notes."—*I. B. B.*

[2] See page 63, footnote 2, of the Memoir in these "Notes."—*I. B. B.*

Patrick I have no influence with any party who can assist him to a situation, as I am perfectly unknown in the Horticultural world. James and Charles have more influence with nurserymen, both dealing with Mr. Knight in the King's-road for seeds, &c., and even Patrick is much better known among gardeners and nurserymen than either of us, having attended most of the flower-shows, and been very successful in gaining prizes, but the fact is a good situation is difficult of attainment unless the influence be considerable. I hope, however, that he will soon succeed, for very few gardeners have been more successful in the cultivation of plants, besides being a very careful and steady man. Fortune has not used him well.

With regard to my father's history I know but little, but what I do know either personally or from others I will endeavour to give in as consecutive a form as possible. I will therefore begin with my great-grandfather, who was a farmer in Mearns or Kincardineshire and who had two sons and one daughter, the eldest of whom Thomas one of whose sons resides in Lower James Street Golden Square London; the second Alexander my Grandfather who was himself a great cultivator of flowers for amusement, and followed the trade of a *Currier* first in Dundee and latterly in Forfar, but ultimately became a manufacturer of *Brogues* which he disposed of in the Highlands; and thirdly Helen the daughter who was married to a Mr. Miller two of whose sons became gardeners one of which was Mr. Miller gardener at Duplin Castle Perthshire and the other Mr Miller of Belmont Castle Forfarshire. My Grandfather Alexander married Jane Fairweather the daughter of a farmer in Mearnshire by whom he had two sons and several daughters, the eldest George my father, so named after his uncle George Fairweather a *Bayordie* a farm so called in Kincardineshire, the next William my Uncle who became a Clock and Watchmaker in Forfar, many watches bearing his name as maker are still to be found in Forfar and its neighbourhood, but he ultimately emigrated to the United States. My father who must have been born in Dundee[1] and was probably first apprenticed to a Clock and Watchmaker there or he may have gone to Dumblane where I know he did work but whether as an apprentice or journeyman I have no means at present of ascertaining. He went to London I have been led to understand by land following his trade in various towns on the road, until he ultimately reached London where he procured work in a shop I believe in Fleet Street, where his expenditure being much greater than his earnings, my Grandfather had to remit him the means of enabling him to return to Forfar where he had then removed. My father about this time appears to have got tired of the Clockmaking business and went to learn Gardening or Horticulture with his cousin Mr. Miller then gardener at Duplin Castle, and here he appears to have made his first botanical excursions and to have formed the acquaintance of the Brown's of Perth, as also with my mother Carolina Clementina Oliphant Stuart who was then employed in Gask House the seat of Mr.

[1] See page 55 of the Memoir in these "Notes."—*I. B. B.*

Oliphant. Shortly after his marriage he removed to Glasgow and followed his original profession of Clock and Watchmaker, and where he made the acquaintance of Bailie Austin, and Dr. Stuart of Luss &c. still however continuing his botanical excursions, this must have been about the year 1793, where his two first children were born both daughters who died in their infancy. He afterwards returned to Forfar I suppose about 1795 or 1796 where my sister you have seen was the first born, afterwards a son George who died in his infancy, the next myself, then David, and then James Brodie all of whom were living when he went to Edinburgh in 1803 or 1804, but the last James Brodie died from teething soon after our arrival in Leith Walk. In Forfar my father, previous to his taking the lease of the Doo-hillock, rented a piece of ground in the neighbourhood where he cultivated plants, following at the same time his profession of Clockmaker. He then got a long lease 99 years of the Doo-hillock from Gray of Carse at a rent of 5 shillings per annum, where he built two houses to which he must have removed as soon as one of them was habitable. This ground the lease of which has still between 50 and 60 years to run has now become very valuable having been converted into a rail-road station. I consider I have been unfairly robbed by my fathers so called friends in Forfar principally lawyers[1] all of whom, however, are now dead. In the year 1803 or 1804 my father went to Edinburgh, through the recommendation of James Brodie of Brodie, leaving the ground at Forfar in charge of my Grandfather, where Patrick was the first born, then James Edward now Gardener at Knole Park near Sevenoaks, Kent. During my fathers residence in Edinburgh, he attended nearly all the medical classes, with the view ultimately of following that profession, the tickets or cards for these lectures with the names of the professors he attended are now in the possession of Patrick since David's death, and which cards you can have by writing to him should you consider them of any use.[2] In Forfar after our return from Edinburgh in 1807 or

[1] See page 60, footnote.—*I. B. B.*

[2] See page 66 and footnotes 2, 3 of the Memoir in these "Notes." The definite statement in this sentence throws a sidelight upon Don's career in Edinburgh which, flickering in Dr. Neill's remarks quoted at the page cited, I abstained from pointing out when his relations with Profesor Rutherford were referred to. It is obvious that Don's ultimate aim to become a medical practitioner and the attendance upon classes and the work requisite for its attainment would scarcely be compatible with that whole-hearted devotion to the Botanic Garden essential in its Principal Gardener. In this of itself there would be an element which might bring about that "want of cordiality" between Don and Professor Rutherford to which Dr. Neill refers, and which may have been the foundation for Mr. Booth's phrases in his letter to Sir J. E. Smith. Allowing this, one may yet admire Don's efforts to secure a position in which he would be independent and able to prosecute his favourite study uncurbed by routine, and if we regret that for his own material success this did not happen we may also reflect that he must have experienced much real happiness amongst the plants in their native homes, and in this would find some recompense for the frowns of fortune.—*I. B. B.*

1808 there were two sons born the first died in his infancy, the second Charles Lyell born in 1810 now Gardener to Lord Beresford at Bedgebury Park near Goudhurst in Kent. About 1811 my father added the nursery-business to that of the Botanic Garden which turned out anything but profitable, the ground being so bad and the labour so expensive. In Jany 1814, my father died as well as my sister and Grandfather, I imagine his complaint was an internal tumour at least it was a desease which none of the medical men in the neighbourhood understood, my Grandmother having died of Scrofula probably also a tumour in 1802, and ultimately my brother David of a similar desease. In Forfar after my fathers return from Edinburgh he formed an extensive collection of plants principally hardy, as well as a considerable herbarium principally British, making numerous excursions to the mountains at the same time following the profession of a country surgeon which he had qualified himself for in Edinburgh.

Had he then thrown up botany he would have done well in his new profession, for he was very successful at first, but this ultimately dwindled in consequence of his being continually out of the way when wanted in search of new botanical discoveries which is not a pursuit adapted for a poor man with a numerous family. After my fathers death I and David endeavoured to continue the business but we were both too young and [in]experienced, actually knew nothing about the matter whatever, and even if we had we could have done nothing surrounded as we were by the Forfar sharks my fathers so called friends. About the end of the year 1815 my mother left Forfar with Patrick, James and Charles to reside at Newburgh in Fifeshire, and my brother David and myself went to Edinburgh. My mother afterwards left Newburgh and went to live at Gask and from thence to Smithy Haugh where she died about 1836 of a desease of the heart.

After my fathers death the only true friends we had besides (yourself) who countenanced myself as well as all my brothers was General Sir David Leighton of the East India Company's Service a relation (cousin) of my father by my grandmother's side and James Brodie of Brodie who both remitted sums direct to my mother on 2 or 3 different occasions.

My fathers publications were few, they were the 1 "Hortus Siccus"; 2 "Plants and Animals of Forfarshire" published in Hederwicks Statistical Account of Forfarshire; 3 A paper on Fiorin grass *Agrostis stolonifera*, published in some Society's Transactions, 4 Some account of the varieties of Scotch-Fir &c.

Answers to your questions.

My father never became an assistant to a Professor of botany in Glasgow it was David. He went from Forfar to Edinburgh not from Glasgow to Edinburgh. He had a lease of 99 years of the Doo-hillock. I am not aware who made him first known to Sir J. E. Smith, however the thing was perfectly easy perhaps Mr. John

Mackay perhaps Mr. James Dickson of Covent Garden. Sir J. E. Smith, however, made my father known to the then Bishop of Carlisle, who kept up a botanical correspondence with him till his death. He was recommended to Dr. Rutherford by James Brodie of Brodie, who after his return to Forfar used all his influence to procure for him Kensington Gardens after the death of Mr. Forsyth, but the present Mr. W. Aitons' power was too great. The garden at Forfar never was sublet during my father's life, but he left it in the care of my grandfather during his residence in Edinburgh, who resided on the spot.

Patrick and James were born at Leith Walk, not Charles who was born at Forfar after our return from Edinburgh. My father began to practise as a Surgeon immediately on his return from Edinburgh. His last excursion to the Clova mountains must have been in 1812; in 1813 he made some excursions to the West Highlands, went to Glasgow and from thence to Edinburgh for the last time when I believe he remained with you at Canonmills during his stay there. It was in autumn of 1814 you visited Forfar in company with Mr. Brown of Perth[1] my father having died the previous January at which time my mother and five sons were then alive, myself, David, Patrick, James and Charles. My sister having died in January about a fortnight after my father, my grandfather also died in the same month, year and place.

I cannot say when you visited Forfar before we removed to Edinburgh,[2] however we went there in 1803 or 1804. My sister, myself and David must have been the only children in existence at that time.

My Father was buried in Forfar Church-yard about a hundred yards from the Church on the South Side towards the East end of the Church.

I believe the only plants my father discovered which have not yet been rediscovered are as you say the Hierochloe borealis and

[1] We have Dr. Neill's own witness to the date of this visit. "I duly received your letter enclosing the order for £31 for behoof of the family of the late Mr. George Don. I scarce know by what fatality I have so long omitted to acknowledge it. I may state however that I waited till I should be able to send on acknowledgement from some one of the Committee at Forfar. This I procured when there in August last, and since that time I have been a good deal from home, in the North of England and elsewhere.

"I went by Perth and proceeded to Forfar in company with Mr. R. Brown of the Perth nurseries (an ardent Botanist, the discoverer of Menziesia coerulea as I once before told you, and who goes almost yearly to our mountains for living specimens of Gentiana nivalis, Bartsia alpina and other rarities) we found the two grown up sons of Mr. Don to be of the most opposite characters [here follow some remarks not complimentary to the son George Don, who apparently was determined to carry on the nursery in spite of the efforts of the Committee to dissuade him]. I have still about £80 in Sir W. Forbes's bank the Committee having wisely delayed drawing upon this fund as long as possible. *Smith Corresp. Linn. Soc.: Dr. Neill to Sir J. E. Smith, 20th October, 1814.*

[2] See page 62, footnote 2, of the Memoir in these "Notes."—*I. B. B.*

Potentilla tridentata, but that is no reason why they should not yet be refound, as it requires a practised eye to be there at the very time of flowering. But many plants become extinct in localities where they were formerly found in abundance.

Look at the life of my brother David in the Penny Cyclopædia compounded by Dr. Lankester, there is hardly a word of truth in it. He makes him attend lectures in Edinburgh when he could not have been more than 3 or 4 years old. Had he given data the thing would have looked ridiculous.

Believe me my Dear Sir Yours very truly,

GEORGE DON.

P.S. Write and let me know whether you have been able to read this scroll.

Dr. Neill must have written questioning some of the statements of the foregoing letter, for we have the following letter from Mr. George Don:—

Mr. George Don (son of the Forfar Botanist) to Dr. Neill.

44 Bedford Place, Cambden Hill, Kensington,
March 21st 1848.

My Dear Sir,—It may be that my father only learned the clockmaking and not the watch making business that mistake lies with me as I believed them to be the same, at least they are generally combined. It is also very possible that you are correct with regard to my father's excursion to England, and that it was connected with gardening, and that his first profession was that of a gardener, and that getting tired of it after his return from England apprenticed himself to a clockmaker in Dumblane; however you might gain some information on this head from Mr James Miller S.S.C. or Solicitor to the Supreme Court in Edinburgh the son of Mr. Miller of Dupplin my father's first master. All the information I have given on this head does not rest on my authority, it was derived from Mr. James Don my father's cousin in London who probably may have been wrongly informed, had I written entirely from my own knowledge without applying to him, the object of my fathers journey to England would have corresponded with what you have said on the subject.

I think Mr. James M'Nab can give you all the information required on the subject of my father's unrediscovered plants probably as you say there are two or three more such as Chærophyllum aromaticum and aureum, the former very distinct species I have seen growing wild myself near Arbroath, the latter is very difficult to distinguish if at all from Ch. sylvestre, it may be a variety; and possibly an Eriophorum, but of this genus I do not think there are more than three distinct species E. alpinum, angustifolium and polystachion, all the others are merely variations of the two latter, depending entirely on soil and situation for any character they may possess.

I will some day soon look over all the plants first discovered by my father, and give you a list of those that have not since been rediscovered.

And believe me to be remaining Yours sincerely,

GEORGE DON.

Dr. Neill.

In the light of this correspondence and its statements conflicting with some of those in the Memoir, we must conclude that at the present time our data are quite insufficient for the compilation of an accurate story of George Don's early life. It will be observed that the son does not answer Dr. Neill's direct question regarding the date of his father's birth, he conjectures the place was Dundee, and after giving a detailed account of his father's training and visit to London admits, when Dr. Neill doubts it, that much of it came from his father's cousin, with whom he is not prepared altogether to agree. It is evident that Dr. Neill's biographical notice, written in his later years and long after the events to which it refers, drew largely for its information upon the letter given above of George Don's son.

It has been stated[1] that a movement was begun in the middle of last century to collect funds for the purpose of erecting a monument to George Don, and we find Dr. Neill referring to this in his letter to George Don's son. Amongst papers of the late Mr. James M'Nab, to which his daughter has kindly granted me access, is the manuscript of a short communication intended for presentation to the Botanical Society of Edinburgh at its meeting in February, 1851—it may not have been read, for there is no notice of it in the minutes of the Society—in which he gives definite form to the general desire of botanists that a monument should be erected. There is no record of how far this movement went, but the following letters, which are printed by permission of Miss M'Nab, show that enquiries were made as to the position of Don's grave and the possibility of placing a monument in Forfar Churchyard:—

George Henderson (Nurseryman, Brechin) to James M'Nab.

Den Nursery,
Brechin, 17 January 1851.

Dear Sir,—We were speaking last year, on the very subject of your letter, to an old Gardener in Forfar a particular acquaintance of the late Mr. George Dons and who accompanied him on many of his excursions in search of plants in this and the neighbouring

[1] See page 88, footnote 3, of the Memoir in these "Notes."

Counties. This person was also present when he died and attended his funeral in the Church Yard of Forfar. He is moreover, if we mistake not a relation of the Sexton of Forfar who has been a good while in office as he is also of the same name. This persons account was, we are sorry to say of the same tenor as the information you already possess. He said it was now quite impossible to distinguish the exact spot or perhaps within some yards of it, but that he recollected near about the bearing of the place from the east end of the Church.

This is probably all the acuracy that could now be arrived at although we were to proceed to Forfar for the purpose [of] instituting an investigation.

I think I was mentioning to you that we had laid out a New Cemetery at Forfar last year. Prior to the opening of it the Old Church Yard was in a fearfully overcrowded state. For many years past they had been too glad to take possession of every bit which the vigilance of relatives did not keep watch upon. In many places the coffins were piled three or four above each other. Poor Mr. Dons nameless grave has probably, therefore, had several other tenants since his remains were laid there upwards of thirty years ago.

Might not the Monument be fastened on to the Church Wall "*Near this spot*"—There are several Mural Monuments there already. . . . .

Dear Sir

Very truly Yours

(Signed) GEO. HENDERSON.

George Henderson to James M'Nab.

Den Nursery,
Brechin, 10 April 1851.

Dear Sir,—We have been extremely busy this long time past and hope therefore you will excuse us for not having sooner attended to your last communication.—We enclose a letter from one of the Bailies of Forfar which will give you the ideas of the people there about the matter.—What he says as to the identy of the spot is of course just hazarded without ever having been to look for the place, and I much fear that since the grave diggers know nothing about it, and since there have been no relatives about the Town to be looking after the place from time to time, other parties would be sure to search in vain—particularly in a Church Yard where no register was ever kept. . . . .

I remain Dear Sir

Yours truly

(Signed) GEO. HENDERSON.

[Enclosure.]

James Ramsay to Messrs. Henderson.

Forfar, 7th April 1851.

Messrs. Henderson & Sons.

Dear Sirs,—I have communicated your letter of 24th ult. to the Magistrates and others and find there will be no objections to the proposed Monument to the memory of the late Mr. Don.

Some of his acquaintances here say they can point out the spot where he was buried, and if the Monument is not placed over his grave, it may be erected on the Church Wall.

The general impression here, however, is that the latter site would be very disadvantageous on account of the great expense &c., and I am convinced a very slight examination of those already up will satisfy any one of this.

Seeing the Old Church-Yard is now shut up, and not in any way resorted to, being so unfit for a place of recreation, a considerable number of influential people here are of the opinion that the *proper place* for the erection would be the *New Cemetery* where an appropriate site would at once be obtained. You might mention this to the promoters and if they adopt this, an attempt may be made to procure a few subscriptions in addition to the gratuitous site.

I am Dear Sirs

Yours truly

(Signed) JAS. RAMSAY.

For permission to print the following copy of a manuscript in the writing of Mr. William M'Nab I am also indebted to Miss M'Nab. It is interesting as giving us some idea from George Don himself of the extent of his collection of plants at Forfar, and it bears out what I have said in previous pages regarding the valuable information upon horticultural and botanical history that would be available should Dr. Neill's papers be discovered:—

NOTES FROM MR. DONS LETTERS TO MR. NEIL 3 & 4 DEC. 1812.

My Botanic Garden where I keep my Collection of Herbaceous Plants and a plant of each kind of Tree and Shrub is measured one Acre but perhaps it is a large one. I entered to it at Whitsunday 1796. I have a lease for 99 years of Charles Gray Esq[r] of Carse. My Collection at present consists of the following *viz*

of Grasses including Carexes and the Remarkable varieties . . .	350
Annuals different species	1250

and if the varieties such as are sold in Seed shops were added would amount to 300 or 400 more would be Total .	.	1600
Species of Shrubs and Trees and the Remarkable varieties . . .	.	1230
Biennials or short lived Plants not including varieties . .	. . .	330
Perennials not including varieties .	. .	2588
If the varieties were added would amount to 400 at least more		
Green House Plants besides varieties .	.	1200

I have a large collection of Roses perhaps more different species than is to be found in any Collection in Britain.

I have I beleive the most extensive collection of Willows that is to be met with in any collection in Britain. I have several new species I have discovered myself of that Family.

I have a few of the best sort of the Pinus sylvestris since I wrote the report I visited that extensive Forrest at Mar Lodge, and I find that all the most remarkable Trees are of that variety. I measured several of them which measured from 15 feet to 18 feet in circumference and they were from 70 to 100 feet in hight.

Rare Green House Plants.

Oxalis secunda
" tetraphylla
" asinina
" coccinea
" incarnata
" repens
" rosacea
Tulbagea alliacea
Tropaelum hybridum
" pinnatum
Laurus fetans
Sempervivum glutinosum
Mimosa saponaria
Salvia spinosa
" hirsuta
Lobelia minuta
" Bellidifolia
Carex australis
Cyperus Brizoides
Bupleurum coreaceum
Campanula saxatilis

(Hardy). Shrubs.

Pyrus nivalis
" angustifolia
Berberis sibirica
" illicifolia
" chinensis
Ribes dicantha
Rubus virginicus
" sanguinolenta
" Intermedius
Rhamnus alioides [alnoides]
Genista hispanica
" Lusitanica
" sibirica
Cornus sibiricus
" circinata
Cytisus elongatus
" Leucanthus
Viburnum ulmifolium
Juniperus alpinus
" repens
Arbutus thymifolia
Vaccinium pensylvanicum
Andromeda Cassinifolia
Spiræa ulmifolia
" chamædrifolia
Robinia macrophylla
Salix lanata of *Linn*
" glauca
" rupestris
Iva frutescens

Empetrum album
Prunus depressus
„ serotina
„ chamæcerasus
„ Susquhana
„ pensylvanica
„ semperflorens
Betula odorata
„ glabra
Clethra scabra
„ acuminata

Rare Roses.

Rosa fenistrata
[1] „ ×suaveolens
„ Teneriffenses
„ Camschatense
„ lucida
„ olympica
„ Cheirokensis
„ mollis
„ caesia
„ ×nivalis
„ ×sanguisorbifolia
„ multiflora

Rare Herbaceous Plants.

Selinum pyrenaicum
Peucedanum caucasicum
Sison salsum
Bubon rigidus
Daucus rigidus
Thapsia fœtida
Panix quinquifolia
Phytemma campanuloides
Dianthus arenareus
Astrantia minor
Viola pensylvanica
„ Rothmagensis
„ villosa
Ranunculus abortivus
Pothus fœtida
Polymnea uvadelia
Geranium Ibericum
Geranium argenteum
Salvia nutans
. . . [name cut off].
Pyrethrum ptarmacifolium
„ Caucasicum

Rare foreign Carexes.

Carex Cyperoides
„ granularis
„ flexuosa
„ crinata

Rare foreign Grasses.

Melica exasparina
Festuca diandra.
„ lævis
„ cristata
Poa peruviana
„ flava
„ laxa
„ Mollinerii
„ Baldensis
Phleum capense
Avena distophylla
Campanula alliarifolia
Scutellaria pubescens
Achillea distans
„ bipinnata
Silene petrea
„ repens
Carduus serratuloides
Astragalus dauricus
„ aristatus
„ austriacus
Trifolium montanum
„ bracteatum
„ expansum
Plantago alpina
Rubus pistillaris
Lysimachia angustifolia
Justicia americana
Euphorbia epithymoides
„ androssæmifolia
Pyrola maculata
„ umbellata

[1] those marked thus × are new species of my discovery.

I need not call to your mind that I was 3 Botanical excursion last summer where I discovered among other things the following rarietis—a non-discript species of *Juncus* and the *Carex rariflora* of Walenberg. vide S[t]ockholm Transactions—and the Beautiful Astragalus campestris of *Linn* a valuable acquisition and the True Salix Lanata of *Linn* by far the Beautifulest of that Genus, besides what I take to be the True Ranunculus nivalis of *Linn* and 2 non discript species of Salix—the Astragalus and Carex and Salix are from the Clova Mountains the others from the high mountains which surround the head of Dee.

Of my discoverys I think the following the most remarkable all of which I have growing in my Garden.

Eriophorum gracile
" capitatum
Phleum Michilii
Arundo stricta
" riparia
Poa depauperata, new species
Avena planiculmis
" poæfolia, new species
Triticum cristatum
" alpinum, new sp.
Rottbœllia filiformis
Aira glomerata, new species
" lævigata
Carex ustulata
" rariflora
" salina
" straminea
Juncus, new species
" gracilis
" castaneus
Galium spurium
" verrucosum
and 2 new species
Sagina maritima
Myosotis repens, new species
Cheriophyllum aromaticum
" aureum
Saxifraga elongilla
" pedatifida
Arenaria chlarifolia
" fastigiata
Stellaria scapigera
Lychnis alpina
Spergula saginoides
Rosa sanguisorbifolia } all new species
" nivalis
" suaveolens
Potentilla tridentata
" opaca
Ranunculus nivalis
" alpestris
Myagrum paniculatum
Draba elongata, new species
Anthyllis alpina, new species
Astragalus campestris
. . . [name clipped off at bottom of page].

OFFICIAL COPY. Number XV.

NOTES

FROM THE

ROYAL BOTANIC GARDEN,

EDINBURGH.

MARCH 1908.

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INVERLEITH PLACE

INVERLEITH LANE

TRADESMAN'S ENTRANCE

HERBACEOUS BORDER

WEIGELA

LONICERA

CAPRIFOLIACEAE

QUERCUS

SOLANACEAE

COMPOSITAE

SCROPHULARINEAE

FAGUS

BUDDLEIA

VIBURNUM

ZELKOWA

ULMUS

QUERCUS

ILEX

CASTANEA

JUGLANS

HEATHS

COLLECTION OF HERBACEOUS PLANTS

RHODODENDRON

RHODODENDRON

ERICACEAE

OSMANTHUS

OLEACEAE

SYRINGA

ROSES

YARD

POND

FRAXINUS

LIGUSTRUM

ELAEAGNACEAE

AESCULUS

SAPINDACEAE

ACER

EUPHORBIACEAE

BUXUS

RHAMNUS

ROSACEAE

LEGUMINOSAE

CARPINUS

CONIFERAE

ALNUS

ANACARDIACEAE

PRUNUS

PYRUS

PHILADELPHUS

TILIACEAE

SPIRAEA

HAMAMELIDEAE

ROSACEAE

RIBES

BETULA

CRATAEGUS

POPULUS

BETULA

ROSACEAE

SALIX

ROCK GARDEN

EAST ENTRANCE

INVERLEITH ROW

INVERLEITH TERRACE

ROSACEAE

WEST ENTRANCE

ARBORETUM ROAD

BERBERIDEAE

MAGNOLIACEAE

A Plants of Dry Regions.
B Economic Plants.
C Central Greenhouse and Corridors.
D Insectivorous Plants.
E Orchids.
F Stove Plants.
G Temperate Ferns.
H Tropical Ferns.
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M Temperate Palms and Tree Ferns.
N Tropical Palms.
O Museum.
P Laboratories.
Q Lecture Hall.
R Herbarium and Library.
S Gentlemen's Lavatory.
T Ladies' Cloak Room.
U Regius Keeper's Residence
V Point for View of the City.
W HeadGardener's Residence
X Gatekeeper's Lodge.

KEY PLAN OF THE ROYAL BOTANIC GARDEN, EDINBURGH.

MARCH 1908.

Area of Garden, 57·648 Acres.

Above Sea-level—Highest point, 109 feet; lowest point, 48 feet.

LINKS 100 0 5 10 15 20

FEET 1000 0 500 1000

GEO. STEWART & Co. EDINR.

THE ROYAL BOTANIC GARDEN, EDINBURGH.

THE Royal Botanic Garden, Edinburgh, is one of the three Gardens maintained by the State in the United Kingdom, the others being the Royal Gardens at Kew in England, and the Glasnevin Garden at Dublin in Ireland. It occupies an unequally-sided quadrilateral area of 57·648 acres (bounded upon all sides by public roads and dwelling-houses) on the North side of Edinburgh—about a mile from the shore of the Firth of Forth. Its highest point, at Inverleith House—the official residence of the Regius Keeper of the Garden—towards the North-west, is 109 feet above sea-level, and thence the ground falls away on all sides. The lowest point—a depression 48 feet above sea-level, with an east and west trend through the middle of the Garden—is the site of an old bog, and the ground rises again to the south of the depression. The surface soil is generally alluvial sand resting on clay at considerable depth. In the lower part of the area the clay comes to the surface.

There are two entrances—one upon the east side from Inverleith Row into the Garden, the other upon the west side from Arboretum Road into the Arboretum.

The **Garden** is open daily from **9 a.m.** on **Week-days** and from **11 a.m.** on **Sundays** until sunset.

The **Plant-Houses** are open from **1 p.m.** until **5.30 p.m.**, or until sunset if this be earlier.

The **Museum** is open on **Week-days** from **10 a.m.** until **5 p.m.** and on **Sundays** from **1 p.m.** until sunset.

The **Herbarium** and **Library** are open on **Week-days** from **10 a.m.** until **1 p.m.**, and from **2 p.m.** until **5 p.m.**, excepting on **Saturday**, when they are open until **1 p.m.**

[Notes, R.B.G., Edin., No. XV., March, 1908.]

Staff of the Royal Botanic Garden, Edinburgh, at March, 1908.

Regius Keeper,	Isaac Bayley Balfour, M.A., M.D., F.R.S.
Assistant in Museum,	Harry Frank Tagg, F.L.S.
Assistant in Herbarium,	John Frederick Jeffrey.
Head Gardener,	Robert Lewis Harrow.
Assistant Head Gardener,	Henry Hastings.
Foreman of Glass Department,	Laurence Stewart.
Foreman of Herbaceous Department,	Charles Dyker.
Foreman of Arboretum,	Alexander Johnston.

RULES for the Royal Botanic Garden and Arboretum in connection with the Regulations prescribed by "The Parks Regulation Act, 1872."

---

1. No unauthorised Person may ride or drive in this Garden or in the Arboretum, and no Wheelbarrow, Truck, Bath-chair, Perambulator, Cycle, or other Vehicle or Machine, is allowed to enter, except with the written permission of the Keeper. Children under ten years of age are not admitted unless accompanied by a Parent or suitable Guardian.

2. No Horses, Cattle, Sheep, or Pigs are allowed to enter.

3. No Dogs are admitted.

4. No Bags, Baskets, or Parcels, no Flowers, and no implements for games may be brought in ; Artists and Photographers may not bring in their Apparatus without written permission from the Keeper.

NOTE.—*The foregoing Rules shall not apply to persons going to or leaving Inverleith House by the road leading from the Arboretum Road Gate to the House.*

5. Visitors are to enter and leave the Plant Houses by the Doors according to the Notices affixed thereon.

6. Smoking is not allowed in the Plant Houses.

7. No Person shall touch the Plants or Flowers.

8. Pic-nics and luncheon parties are not allowed.

9. No unauthorised Person shall Drill or practise Military Evolutions or use Arms or play any Game or Music, or practise Gymnastics, or sell or let any Commodity.

10. No unauthorised Public Address may be delivered in the Garden or Arboretum. No Performance or Representation either spoken or in dumb show shall be given in any part of the Garden or Arboretum, unless by permission of the Commissioners

of His Majesty's Works and Public Buildings. No Person shall use any obscene, indecent, or blasphemous words, expressions, or gestures, or do any act calculated to provoke a breach of the Peace, in the course of, or in connexion with, any speech, address, performance, recitation, or representation. No money shall be solicited or collected in connexion with any performance, recitation, or representation, except by permission of the Commissioners of His Majesty's Works and Public Buildings.

11. Large parties must be broken up to prevent crowding.

12. Climbing the Trees, Railings, or Fences is forbidden.

13. Birds'-nesting, and taking, destroying, or injuring Birds or Animals are forbidden.

14. The distribution of Handbills, Advertisements, and other Papers by the Public is forbidden.

Dated the 28th day of April 1904.

Sealed with the Common Seal of the Commissioners of His Majesty's Works and Public Buildings.

SCHOMBERG K. M'DONNELL,
Secretary.

Seal

Historic Notice.

In the year 1670 a small portion of ground, known as St. Ann's Yards, lying to the south of Holyrood House, and usually let to market gardeners by the Hereditary Keeper of Holyrood House, was occupied by two eminent Edinburgh physicians, **Andrew Balfour** and **Robert Sibbald,** for the making of a Physic Garden, and **James Sutherland** was appointed to the "Care of the Garden." This was the foundation of the Royal Botanic Garden of Edinburgh, which is therefore, after that of Oxford (founded in 1632), the oldest in Great Britain. The Garden was stocked with plants from the private Garden of Dr Andrew Balfour, in which for some years he had been accumulating medicinal plants, and also in great measure from that at Livingston in West Lothian, the laird of which, Patrick Murray, was much interested in the growing of useful plants. Shortly thereafter, but at what precise date has not yet been ascertained, Sutherland became custodian of the Royal Garden, which lay on the north side of the Palace, and it became a Physic Garden for instruction, whilst the original plot in St. Ann's Yards was, apparently, given up.

In 1676 the same physicians acquired from the Town Council of Edinburgh a lease of the Garden of Trinity Hospital and adjacent ground for the purpose of a Physic Garden in addition to the Garden already existing at Holyrood, and they appointed the same James Sutherland (16..-1715) to be "Intendant" of this Garden. The site of this Garden, which for convenience of reference may be called the Town's Botanic Garden, was the ground lying between the base of that portion of the Calton Hill upon which the prison is built and the North Bridge, and it is now occupied by a portion of the Waverley Station of the North British Railway. The name Physic Garden attached to a street in the vicinity is a reminiscence of the existence of the Garden at this spot.

About 1702 another Botanic Garden was established in Edinburgh in the ground immediately adjacent to the College Buildings, apparently on the site of the present South College Street. This was the College Garden, and of it James Sutherland became also custodian.

Thus in the early years of the eighteenth century there were in Edinburgh three distinct Botanic or Physic Gardens—one at Holyrood, the Royal Garden ; one around Trinity Hospital, the Town's Garden ; and one beside the College, the College Garden—all under the care of James Sutherland.

Sutherland from the first made use of the Royal Garden for giving "instruction in Botany to the Lieges," and received a royal warrant appointing him Botanist to the King in Scotland, and empowering him to "set up a Profession of Botany" in this Garden. When the Town's Garden was created the Town Council appointed him to lecture on Botany as Professor in the Town's College, now the University of Edinburgh. In 1683 he published his "Hortus Medicus Edinburgensis, or a Catalogue of the Plants in the Physical Garden at Edinburgh," from which and from other published notices we learn that between two and three thousand plants were in cultivation. There are no data available from which to determine how these plants were distributed between the several Gardens at the date of publication of Sutherland's catalogue.

In 1706 Sutherland resigned the care of the Town's Garden and the College Garden as well as his Professorship in the University, but, remaining King's Botanist, he retained the care of the Royal Garden at Holyrood. Charles Preston was appointed his successor by the Town Council, and there were thus established rival Gardens and rival Professors of Botany in Edinburgh. Charles Preston died in 1712, and was succeeded in his offices by his brother George Preston. Neither of the Prestons had ever the care of the Royal Garden.

Sutherland's appointment as King's Botanist, Keeper of the Royal Garden, and Regius Professor of Botany was held during the pleasure of the Sovereign, and on the death of Queen Anne in 1714 he was not continued in office by George I.

In 1715 **William Arthur** (. . . . -1716) received a commission as successor to Sutherland, but as he was implicated in an

unsuccessful Jacobite plot to seize the Castle, he did not hold the office long.

He was succeeded in 1716 by **Charles Alston** (1683-1760).

In 1724 the College Garden, having fallen into disorder, was turned to other uses; and in 1729, George Preston having retired, the Town Council appointed, as his successor in the charge of the Town's Garden and as Professor of Botany in the University, Charles Alston, who as King's Botanist had already the charge of the Royal Garden and was Regius Professor of Botany. Through him, after separation for a quarter of a century, the Royal Garden and the Town's Garden were again combined under one Keeper, and the Regius Professorship of Botany and the University Professorship were similarly united. They have so continued to the present time.

In 1763, the Royal Garden and the Town's Garden proving too small and otherwise unsatisfactory, **John Hope** (1725-1786), who had succeeded Alston in his offices in 1761, proposed a transference of the two to a more congenial site in which they could be combined. At first it was intended to secure ground to the south of George Watson's Hospital—the area upon which much of the present Royal Infirmary is built—but this not being possible, five acres of ground to the north side of Leith Walk, below the site now occupied by Haddington Place, were chosen. As Hope proposed to transfer the collections in the Royal Garden to the new Garden he was able to secure the support of the Treasury to his scheme, and the selected ground was leased in name of the Barons of Exchequer. At the same time the Town Council agreed to contribute £25 annually to the support of the Garden, this sum being the amount of rent expected from the letting of the old Town's Garden. The plants from both Gardens were transferred to the ground at Leith Walk, and from this date there has been only one Botanic Garden in Edinburgh. The site thus secured for the Garden proved, however, only a temporary one.

Daniel Rutherford (1749-1819), who in 1786 succeeded Hope in his offices, cast about him for a spot in which more ground would be available for the extension of the Garden; and eventually in 1815 nine and a half acres of the land lying to the east of Holyrood Palace, and forming the ground of

Belleville or Clockmill, was fixed upon as a site. This selection gave rise to controversy which was prolonged, and Rutherford died before any arrangements for the transference of the Garden had been made.

Robert Graham (1786-1845), his successor, appointed in 1820, preferred the more open site of the Inverleith property which the Garden now occupies, and fourteen acres of the Field or Park of Inverleith, known as Broompark and Quacaplesink, were purchased by the Barons of Exchequer from Mr James Rocheid, its owner, in 1820,the lease of the Leith Walk Ground being sold. By 1823 all the plants had been transferred to the new Garden.

In 1858, during the Keepership of **John Hutton Balfour** (1808-1884), who succeeded Graham in 1845, a further addition, by purchase from the proprietor of Inverleith, of a narrow belt of two and a half acres was made to the Garden on the west side; and in 1865 the Caledonian Horticultural Society having resigned to the Crown its lease of the ten acres of adjoining ground which it had occupied since 1824 as an experimental Garden, this ground was also made part of the Botanic Garden. Finally the present area of the Garden was completed in 1876, when the Town Council purchased from the Fettes Trustees twenty-seven and three-quarter acres of Inverleith property on the west side of the Garden and transferred it to the Crown for the purpose of making an Arboretum in connection with the Garden; the Crown at the same time purchased Inverleith House and two and a half acres of additional ground.

In 1879, **Alexander Dickson** (1836-1887) became Queen's Botanist, Regius Keeper and Professor, and held these appointments until his death in 1887. During his term of office the Arboretum was opened to the public.

Surrounded as it now is on all sides by public roads, no further extension of the Garden upon its present site can be made.

Regius Keepers (R.K.)

from the

Foundation of the Garden.

JAMES SUTHERLAND, . .	Born 1639? R.K. 12th January, 1699?* Retired 1715. Died 24th June, 1719.
WILLIAM ARTHUR, . .	R.K. 10th May, 1715. Died 1716.
CHARLES ALSTON, . .	Born 1683. R.K. 30th June, 1716. Died 22nd November, 1760.
JOHN HOPE . . .	Born 10th May, 1725. R.K. 13th April, 1761 Died 10th November, 1786.
DANIEL RUTHERFORD, .	Born 3rd November, 1749. R.K. 20th December, 1786. Died 15th December, 1819.
ROBERT GRAHAM, . .	Born 7th December, 1786. R.K. 31st January, 1820. Died 7th August, 1845.
JOHN HUTTON BALFOUR, .	Born 15th September, 1808. R.K. 8th November, 1845. Retired 1880. Died 11th February, 1884.
ALEXANDER DICKSON, .	Born 21st February, 1836. R.K. 28th April, 1880. Died 30th December, 1887.
ISAAC BAYLEY BALFOUR, .	Born 31st March, 1853. R.K. 5th April, 1888.

* This is the date of a Royal Warrant from William III., and no earlier one has been found.

Principal Gardeners (P.G.) from the Year 1756.

(The Names of those preceding Williamson are not yet known.)

JOHN WILLIAMSON, . .	P.G. 1756? Died September, 1780.
MALCOLM M'COIG, . .	P.G. 1st January, 1782? Died 25th February, 1789.
ROBERT MENZIES, . .	P.G. 1789? Died 1799?
JOHN MACKAY, . . .	Born 25th December, 1772. P.G. February, 1800. Died 14th April, 1802.
GEORGE DON, . . .	Born October, 1764? P.G. December, 1802? Resigned 1806? Died 15th January, 1814.
THOMAS SOMMERVILLE, .	Born 1783? P.G. 1807? Died 17th March, 1810.
WILLIAM M'NAB, . . .	Born 12th August, 1780. P.G. April, 1810. Died 1st December, 1848.
JAMES M'NAB, . . .	Born 25th April, 1810. P.G. 1st January, 1849. Died 19th November, 1878.
JOHN SADLER, . . .	Born 3rd February, 1837. P.G. 13th January, 1879. Died 9th December, 1882.
ROBERT LINDSAY, . .	Born 7th May, 1846. P.G. 3rd March, 1883. Retired 31st March, 1896.
ADAM DEWAR RICHARDSON,	Born 12th September, 1857. P.G. 1st April, 1896. Resigned 31st May, 1902.
ROBERT LEWIS HARROW, .	Born 26th March, 1867. P.G. 1st June, 1902.

Features of the Garden.

The method through which the Garden was built up by successive additions resulted in an absence of combination between its several parts, in great measure a consequence of want of adequate funds to make the necessary alterations in the grounds. During the past eighteen years, in which the Garden has been wholly under the administration of the Commissioners of H.M. Works, the bringing about of this combination has been in progress. The work is not yet completed, and the Plan of the Garden which is attached to this sketch shows the area of the Garden as it is laid out at this date—October, 1907. Future editions will show further changes as the work of reconstruction proceeds.

From its foundation the Botanic Garden has been devoted to the teaching of Botany, and its usefulness in this respect has determined the laying out of its area.

Herbaceous Garden.—A considerable space is occupied by a collection of herbaceous plants arranged for study in natural orders.

Rock Garden.—There is an extensive rockwork upon which alpine and rarer herbaceous plants are cultivated.

Arboretum.—The whole of the western area of the Garden is in process of arrangement as an Arboretum of trees and shrubs, and the positions of some of the chief genera are indicated on the plan. The Coniferæ are now placed in the ground adjacent to the Rock Garden.

Herbaceous Border.—Along the North Boundary of the Arboretum a mixed Herbaceous Border has been planted.

The **Plant-Houses** are still in process of reconstruction. So far as they have been rearranged at the present time they consist of a long range to the north of the herbaceous collection, composed of a Central Green-house (**C**), from the sides of which two Corridors run east and west. In the Entrance Porch (**D**) to the Central Green-house is a collection of Insectivorous Plants.

From the Eastern Corridor two houses project to the south—one (**A**) occupied by Plants of Dry Regions, the other (**B**) containing Economic Plants of both Tropical and Temperate Regions. The House terminating the Eastern end of this Corridor is one of the old and decayed plant-houses, to which visitors are not admitted pending its reconstruction. To the south side of the Western Corridor are attached two houses—one (**E**) for Orchids and one (**F**) for Plants of Tropical and Warm Regions. The western end of the Corridor opens into a domed house (**G**) for Ferns of Temperate Regions, and attached to it are two houses running southwards, one of which (**H**) is occupied by Tropical Ferns, and the other (**I**) is used as a Heath House. From the northern wing of this domed house opens a house (**J**) devoted to monocotylous Plants of Tropical and Warm Regions, specially Aroids, Scitamineæ, Liliaceæ, and Amaryllidaceæ; Pitcher Plants are also provided for in this house. Out of this opens the house (**K**) for Bromeliads; and in another house (**L**) opening from this is a collection of plants requiring warm temperate environment. Behind the western end of the Front Range there is a Temperate House (**M**) for Palms, Tree-Ferns and Coniferæ, and a Palm-House (**N**).

Adjoining Inverleith Row is a group of buildings including the **Museum** (**O**), the **Laboratories** (**P**), and the **Lecture Hall** (**Q**).

The **Museum** contains a series of exhibits illustrating the form and life-history of plants, and these are arranged so as to facilitate their use in teaching.

Herbarium and Library.—In the southern portion of the Garden is the Herbarium and Library (**R**). It contains a fair representation of the Floras of the world, and the herbarium of plants belonging to the University of Edinburgh is deposited here.

The **Ladies' Cloak-Room** is at (**T**) at the side of the path leading along the eastern boundary. A **Gentlemen's Lavatory** will be found at (**S**).

From the higher ground of the Arboretum—at the point marked (**V**) on the plan—a fine panoramic view of the City of Edinburgh. flanked on the east by Arthur's Seat, and on the west by the Pentland Hills, is obtained.

Teaching in the Garden.

Special instruction in the sciences underlying the practice of Horticulture and Forestry is provided for the Staff of the Garden. The course of instruction is spread over three years, and consists of lectures upon, and practical instruction in, the sciences taught. A Reading-room and Library is also provided for members of the Staff going through the course. Young Gardeners or Foresters desiring admission to the Staff and the course of instruction should make application to the Regius Keeper.

The Regius Keeper from time to time gives lectures which are open to the Public. The Laboratories are open to anyone desirous of undertaking Botanical Research.

For more than a century and a half the offices of Regius Keeper of the Botanic Garden and Professor of Botany in the University of Edinburgh have been held by the same person, and it has become the custom that the students of the University come to the Garden for instruction in Botany.

Specimens for private study are supplied, as far as the resources of the Garden will permit, to visitors and students who make written application to the Regius Keeper. Application forms may be obtained at the office of the Garden.

Enumeration of Visitors to the Royal Botanic Garden, Edinburgh, during the Years 1889-1907.

ON the 1st of April, 1889, the control of the Royal Botanic Garden, Edinburgh, was vested in the Commissioners of His Majesty's Works, and the Garden became subject to the "Act for the Regulation of the Royal Parks and Gardens, 1872." From the date specified the Garden was opened to the public on Sundays, and was also opened for an extended period on Week-days. The subjoined table shows the number of visitors to the Garden on Sundays and Week-days respectively during the nineteen years which have elapsed since the Garden was transferred to the Commissioners of His Majesty's Works:—

Year.	Total in Year.	Total on Sundays.	Largest Number on a Sunday.	Smallest Number on a Sunday.	Total on Week Days.	Largest Number on a Week Day.	Smallest Number on a Week Day.
*1889 ...	368,219	187,457	13,935	129	180,762	3,834	50
1890 ...	446,540	216,345	11,265	91	230,195	4,032	65
1891 ...	454,083	220,543	9,445	340	233,540	3,228	76
1892 ...	437,205	218,233	13,581	149	218,972	2,666	43
1893 ...	531,232	271,893	12,860	45	259,339	3,197	40
1894 ...	526,948	268,793	13,515	68	258,155	3,153	28
1895 ...	516,608	264,497	15,227	127	252,111	5,292	26
1896 ...	516,407	296,576	13,517	527	219,831	3,825	30
1897 ...	475,210	271,730	16,001	74	203,480	3,153	20
1898 ...	443,289	258,499	12,840	123	184,790	3,234	39
1899 ...	461,686	259,424	15,161	105	202,262	2,758	30
1900 ...	561,359	324,856	17,700	268	236,503	3,667	53
1901 ...	586,461	339,229	19,256	258	247,232	4,627	45
1902 ...	522,363	295,892	15,561	165	226,471	5,461	60
1903 ...	606,184	355,310	19,583	135	250,874	4,202	41
1904 ...	639,066	367,290	20,719	374	271,776	3,564	42
1905 ...	584,546	330,995	19,859	100	253,551	2,708	60
1906 ...	699,558	394,030	21,959	84	305,528	3,760	44
1907 ...	674,208	422,899	25,601	708	251,309	3,365	40
Total for Eighteen Years.	10,051,172	5,564,491	...	...	4,486,681	...	...

*** Numbers in this year for nine months only.**

Thomas Sommerville.

The uncertainty which, as we have seen, surrounds the date of Don's quitting his post as Principal Gardener attaches also to the time of advent of his successor, who was Thomas Sommerville. Assuming that the appointment was made in 1807, at the end of which year we know that Don was again settled in Forfar, Dr. Rutherford's choice had fallen upon a young man of some twenty-four years of age, and the presumption is that he was a lad trained and working in the Garden.[1] But of this and of incidents in the life of Thomas Sommerville, we know nothing. His tenure of office was short, for he died on 17th March, 1810, in his twenty-seventh year,[2] and was buried in St. Cuthbert's Burying Ground.[3]

The only references I have met with in literature to Thomas Sommerville are these :—

A writer, under the pseudonym "Quoth Timon," of an article in the *Scots Magazine*, LXXI (1809), p. 404, entitled "Some Suggestions for the Improvement of the Edinburgh Botanic Garden," says—"Here we shall, in the first place, express the satisfaction we derive from the admirable style in which the Botanic Garden is at present kept, at least in so far as depends on the Superintendent[4]. We have long been familiar with this garden ; but at no period in our observation can we discover a more judicious plan to have been pursued in the management of the various plants (which indeed their health so strongly indicates), or better taste in the general system. In gardening, every likely

[1] This presumption is supported by Prof. Rutherford's confession of embarrassment in the selection of a successor to Sommerville through having no one on the garden staff qualified for the post. See his letter of 19th March, 1810, to Sir Joseph Banks on p. 294 of these "Notes."

[2] "Died on the 17th March, aged 27, Mr. Thomas Sommerville, Superintendent of the Royal Botanic Garden, Leith Walk ; a young man of great abilities both as a professional gardener and botanist."—*Edinburgh Courant*, March 22, 1810. Also *Scots Magazine*, LXXII (1810), where the name is spelled "Somerville" and the place of death is given "at his house, on Leith Walk."

[3] "Thomas Sommervell from Bottany Gardens on shoulders."—*Journal of St. Cuthbert's Burying Ground*, March 21st, 1810.

In Miss McNab's possession is a "Catalogue of Minerals, Fossils, Books, &c., which belonged to the late Mr. Thos. Somerville, Manager of the Botanic Garden, Edinburgh.—To be sold on Saturday, April 28, 1810, at his house, Botanic Garden, Leith Walk, by Wm. Bruce, jun."

[4] At this time Sommerville.

exhibition of what is beautiful in nature has a fine effect; winding walks, where the line of beauty is observed, are peculiarly pleasing; at every turn we experience increased pleasure, from the combined beauties of art and nature; and in this particular we remark the walks lately laid out in this garden, which certainly do honour to the good taste of the projector."[1]

In the same Magazine, LXXII (1810), p. 166, Dr. Neill, in a short note about the Botanic Garden, says—"This unfortunate garden, on the neglected state of which we have, for the last two years, been occasionally commenting, has sustained an additional misfortune in the loss of its superintendent, Mr. Thomas Sommerville. This promising young man, after having lingered for many months in a gradual decline, died on the 17th instant, at the early age of 27. He possessed very considerable abilities, both as a professional gardener and a botanist; and had he lived, would doubtless have distinguished himself in this latter respect."

Mr. Robert Maughan,[2] in a footnote to "A List of the rarer Plants observed in the neighbourhood of Edinburgh (Memoirs of the Wernerian Natural History Society, Vol. I (1811), p. 246), refers to Sommerville as "a young man of very promising abilities both as a professional gardener and as a botanist."[3]

From these notices we may gather that Sommerville was a competent Principal Gardener, and that, like his immediate predecessors, he was also diligent in search after native plants.

[1] The style of the article suggests Dr. Neill as the writer.

[2] Robert Maughan (1769-1844): b. Edinburgh, 1769; d. London, 1844. F.L.S. 1809. Deputy Controller of Inland Revenue in Scotland. Original Member of the Botanical Society of Edinburgh. Made large herbarium of Scottish plants which he took to London, where he settled with a married daughter in 1840 on retirement from the Civil Service. His son, Edward James Maughan (1790-1868)—(b. Edinburgh, 1790; d. Edinburgh, 1868. Inspector of Taxes at Perth, afterwards at Edinburgh)—was also a keen botanist, and like his father is the authority for the localities of many Scottish plants in "Floras" of the first half of last century. To Miss Maughan, daughter of E. J. Maughan, who, with her sisters, is living at this date in Edinburgh, I am indebted for the information in this note.

[3] Sommerville is cited in the list, which was in the press at the time of his death, as authority for the following plants and localities:—*Beta maritima*, seashore near Kirkcaldy; *Convallaria majalis*, Arniston and Collington Woods; *Epipactis cordata*, firwood between Woodhouselea and the Bush, peat-bog near Ravelrig Toll, on the Pentlands; *Papaver cambricum*, banks of Water of Leith near Woodhall; *Polytrichum alpinum*, Eastern Cairn Hill, one of Pentlands; *Pulmonaria maritima*, Fifeshire coast near Seafield Tower; *Orchis Conopsea* var. *flore albo*, meadow ground south of Dalmahoy Hill; *Rubus Chamæmorus*, top of Eastern Cairn Hill; *Saxifraga umbrosa*, Auchindenny Woods; *Utricularia minor*, peat-pit near Ravelrig Toll.

William M'Kee.

William McNab.

With Portrait.[1]

Through Sommerville's death, Prof. Rutherford found himself called upon to appoint a Principal Gardener for the fifth time during his tenure of the Regius Keepership—to date of twenty-three years. Fortune had not smiled on his appointments so far. Three of the men whom he had chosen had died in harness—two of them when still young and giving promise of much in the future—and the fourth had left because of strained relationships, as we have reason to think. We may imagine, therefore, that the making of this new appointment would give him some concern, which would not be lessened because of its urgency in view of the near approach of the beginning of the Summer Session of the University. There was no one on the staff of the garden, as we learn from him in a letter printed hereafter, whom he could promote, and the salary of the post appears to have been inadequate as an attraction to an outsider. On this latter point we have Dr. Neill writing at this time in his note, already referred to, in the *Scots Magazine*, LXXII (1810), p. 166, and giving strong expression to what we may suppose to have been the general feeling regarding it. He says :—

"While the situation of superintendent is thus vacant, it can give no offence, we should suppose, if we remark upon the insufficiency of the salary. Forty years ago, the keeper of the Botanic Garden may have found himself 'passing rich with forty pounds a year.' But that such a pittance must now be utterly inadequate is too evident to require illustration. In this country there is little difficulty in finding men of merit in the gardening profession ; indeed, Scottish gardeners are held in repute all over the empire. Several excellent cultivators and keen botanists have, during the last ten years, issued from the Edinburgh Botanic Garden itself. To become Superintendent of the Physic Garden of Scotland is justly accounted a horticultural and botanical honour. But it is hard to ask a person to

[1] I am indebted to Miss McNab, granddaughter of William McNab, for the photograph from which this portrait has been taken. The only published portrait of William McNab is one in profile from a sketch by his daughter, a copy of which was given to each subscriber to the testimonial presented to Mr. McNab in 1844 (see page 316).

leave a situation where he receives from £60 to £100, and to offer him £40 a year. The 'feather in his cap' will not, in these times, make up for the deficiency. The perquisites of the place are very trifling and uncertain, and we understand, cannot be reckoned worth more than £10 a-year."

The steps taken by Prof. Rutherford to fill the vacancy are shown in the following letters :—

Dr. Rutherford to Sir Joseph Banks.[1]

Edin. 19 March 1810.

Sir,—I trust that you will pardon the liberty I take of applying to you in the present occasion, as I know no one who is so capable of giving me advice and assistance as you are. I must take the liberty of acquainting you that Mr. Sommerville, who was gardener of the Botanic Gardens in this place, is just dead, and I am in the greatest anxiety to fill up the place properly, and indeed as soon as possible, since the season of the year is now so far advanced. Unfortunately the workmen now in the garden are in a manner entirely strangers to me, having come into it only a week or two ago, and I am thus more embarrassed than I should otherwise be. Such being the case, I should esteem it as a singular obligation if you could recommend any person that you think might be qualified for the office. I need say nothing of the talents required, you are a perfect judge of this subject. The Emoluments are £40 a year salary and whatever gratuities may be given by people who visit the garden, besides I allow him 2/6 from each of the students. Should you recollect any fit person who might incline to enter in this employment, I shall esteem it as a particular favour if you take the trouble to mention him to me. I hope you will excuse the liberty I have taken. I have the honour to be with the greatest respect, Sir,

Your most obed. and most humble Servant,

(Sgd.) D. RUTHERFORD.

Sir Joseph Banks to Mr. Aiton.[2]

My dear Sir,—I send the enclosed to you as a matter of course, if it should be the means of providing for any one of your worthy lads it would be a great satisfaction to me but I fear the salary is much too small unless the Emoluments make a much greater addition to it than can be expected.

Always Yours

JOS. BANKS.

March 22, 1810.

[1]

[2] William Townsend Aiton (1766-1849). See Britten and Boulg., Bibliog. Index. Printed by permission from a copy in the possession of Miss McNab.

Sir Joseph Banks to Dr. Rutherford.[1]

My Dear Sir,—The high respect I feel for the Botanic Institution at Edinburgh and the personal regard I have for the worthy Professor have made me anxious to fulfil the commission contained in your last favour. I therefore applied without delay to Mr. Aiton whose foreman I knew to be particularly qualified to fill the office now vacant in your garden, being a man eminently skilled in the names of plants, as well as in their culture, modest, unassuming, quiet, civil and obedient. As he has been 10 years at Kew Mr. Aiton is desirous of providing for him and will therefore readily part with him if he thinks the offer likely to produce and secure a comfortable settlement for life. Of this however McNab the foreman has some doubts, and in truth as the price of every necessary of life has of late increased materially, and still continues to increase, or rather as the value of money diminishes every day his doubts are not without a rational foundation.

I have however brought him to say that if £10 a year can be added to the salary of £40 he will thankfully accept the place.

Whether this is feasible or not I cannot at all judge. I can only say that as it seems necessary that all fixed salaries should keep pace in their advancement with the admitted depreciation of money, the present is a very proper time to make an addition, and this as I do not know that there is in England so proper a man for the present vacancy as McNab is. He has all the knowledge both of botanical nomenclature and of Horticulture that Don[n][2] now gardener of Cambridge possesses—I think in a better style, and he is more modest and unassuming by far.

If it is not practicable to obtain an increase of salary I shall still do my endeavour to persuade him to accept the place as I think he may be confident that an addition must soon be made, if it cannot be done at this time.

I am My Dear Sir,

Your very faithful and very humble Ser.

(Sgd.) Jos. BANKS.

26 March 1810.

Edinr. 1 April 1810.

Dr. Rutherford to Sir Joseph Banks.[3]

Dear Sir,—I had the honour to receive your very kind letter two days ago, and I beg leave to offer my most earnest thanks for the trouble you have so readily taken, in procuring a gardener for the Botanic Garden. The salary of £40 which I mentioned, was what I had been in use of allowing. Surely I can have no objection to

[1] Printed by permission of Miss McNab, who has the original letter.

[2] James Donn (1758-1813). See Britten and Boulg., Bibliog. Index.

[3] Printed by permission from a copy in the possession of Miss McNab.

raising it to £50 or some shillings below £50 just to avoid the Tax. Indeed I had determined to do so as soon as I was assured of an additional allowance for the maintenance of the Garden, which I believe is already granted. I hope then that Mr. MacNab will have no objection to the Place; everything that depends upon myself shall be done to render his situation comfortable and agreeable, only one article I should wish him to understand that nothing whatever is to be sold or given from the Garden unless with my permission. Indeed I have had occasion to remark such depredations, unfortunately not however just at the time things were removed, as can hardly be repaired.[1] You may believe that I am anxious that he could be with me as soon as possible and I should be extremely obliged to you if you convey him such intelligence. Indeed I should like to hear from him as there are some plants which I wish him to provide for me before he leaves London. I am quite ashamed to use such freedom with you, but I sincerely hope you will pardon me when you consider the anxiety I have to fix a proper person in the Garden.

I have the honour to be with highest respect and esteem

Dear Sir,

Your most obedient and most humble Servt.

D. RUTHERFORD.

Fortunately for the Edinburgh Garden the post thus offered to William McNab had sufficient attractions to induce him to make the pecuniary sacrifice involved in acceptance of it, but it was not until May that he came to Edinburgh, as we learn from the following letter of introduction :—

Mr. W. T. Aiton to Dr. Rutherford.[2]

Dear Sir,—This letter will be delivered to you by my much esteemed friend Mr. William McNab, many years my principal foreman in the Royal Gardens at Kew. Altho I think it unnecessary to add any thing to the testimony of the great and good Sir Joseph Banks, in favour of this very promising young man, I cannot refrain observing that McNab enjoys in a superior degree the best requisites of his profession as a gardener, and the sincerity and real worth of an honest Man, and as such I beg leave to introduce him to your protection. being Dr. Sir with great regard very faithfully yours

W. T. AITON.

Kew Gardens,
12 May 1810.

[1] Have we here a hint of a cause of "want of cordiality" between Professor Rutherford and George Don? See page 66 with footnotes 2 and 3, and page 281 with footnote 2, of this volume.

[2] Printed by permission from a copy in the possession of Miss McNab.

William McNab, who thus entered upon his duties in the Royal Botanic Garden at Edinburgh, and who of all the Principal Gardeners stands highest in reputation in Horticulture and is deservedly placed in the front rank of the world's gardeners, was born one of a family of twelve[1] 12th August, 1780, at Knockcavish,[2] in the parish of Dailly, Ayrshire, where his father, James McNab, was farmer. During boyhood he assisted his father in the work of the farm, and at the age of sixteen began apprenticeship to gardening in the garden of Mr. Kennedy of Dunure, at Dalquharran in Carrick. At the end of a three year period there he obtained, through Messrs. Dickson & Co., of Edinburgh,[3] a situation in the gardens of the Earl of Haddington at Tyningham in East Lothian. Thence he went in 1801,[4] after fourteen months' service,[5] to London with a recommendation to William Aiton, of the Royal Gardens at Kew, by whom he was engaged on 12th March for employment under him at Kew.

[1] Of his brothers:—James became factor first at Kerraughtry, afterwards at Culloden; another, Gilbert, became Sheriff-Clerk Depute of Ayrshire 20th June 1821, as I am informed by Sheriff-Clerk Patrick of Ayr.

[2] Variations in spelling taken from popular pronunciation occur, such as Knockcaves, Knockawish, and in the Birth Register the word is written Knockaways. The Rev. George Turnbull, D.D., of Dailly, has kindly given me this information.

[3] At the time leading Nurserymen in Edinburgh. They have already been referred to in these "Notes" as friends of Mackay and Don.

[4] "That the Bearer William McNab a young unmarried Man by Trade a Gardener, Aged about twenty years, has lived in this Parish, mostly from his Infancy to this present Date, when he intends to leave it, and go to London or its neighbourhood, in order to gain farther insight into his said Trade of Gardener, and has always behaved himself in a sober, honest, and regular manner, free of all public scandal or Grounds of Church censure known here—Is by appointment of the Kirk of Session of this Parish of Dailly, County of Air, North Britain, given and signed in their name the twenty-fifth day of January One thousand eight hundred and one years by—John Thomson, Minister; James Welsh Sess. Clerk."—*By permission of Miss McNab, who has the original.*

John Thomson (1778-1820) who signed these "lines" was the renowned landscape painter who moved to Duddingstone in 1805, and is commonly known as "Thomson of Duddingstone." He also was born in the parish of Dailly. In after years McNab, on his return to Edinburgh, renewed personal acquaintance with Mr. Thomson, and an intimate friendship continued until Mr. Thomson's death.

[5] "This is to certify that the Bearer William McNab served as Journeyman Gardener for the Space of 14 months in the Earl of Haddington's Gardens at Tynningham—In which time He Behaved Himself soberly and Honestly always paying due attention to His Business—Thomas Thomson; Tynningham, Novr. 8th, 1800."—*By permission of Miss McNab, who has the original.*

In 1803 he succeeded William Kerr as foreman there, in which position he continued until after nine years' service he received the call to Edinburgh.

The times were troubled when William McNab found himself thus within a circle where the personal influence of King George III. was dominant. It is recorded of McNab that he attracted in a special manner the attention of the King, and this, we may believe, not merely because of his capacity as a gardener but no less on account of the enthusiasm with which he threw himself into projects for the defence of the Country.[1] For the King took great interest in the Volunteer movement of the time and particularly in that current of it which affected the area in and about his own domain at Kew, and the fact that young McNab joined the Corps of Kew Volunteers[2] at its institution[3] would be known to the King and be a commendation in his eyes.

[1] Through the Rev. Dr. Turnbull of Dailly, I learn that a niece of William McNab, Mrs. Andrew Hannah, aged about 80, is at this date living in the parish of Dailly, and relates that "the King, struck by his appearance, said to him that he ought to be in the army."

[2] Here is a copy of McNab's enrolment card:—"William McNab | Enrolled a Volunteer | in the | Kew | Volunteer Infantry | Who Loyally and Voluntarily offered his | personal service in the defenee of his | King | and | Country | September 1803. |" On the reverse of the card there is:—"The Engagement | with the | Rules | and | Regulations | of the | Kew | Company of | Volunteer Infantry | Brentford | Printed by P. Norbury | 1803. |"—*By permission of Miss McNab, who has the original.*

[3] The following is a copy of the Appeal for Volunteers which McNab had preserved:—"ADVANTAGES | Obtained By | VOLUNTEERS, | SERVING in DEFENCE of their COUNTRY. | KEW, | August 11, 1803. | The Committee wish to point out to the Inhabitants of the Parish of Kew, the advantages that will arise in forming a VOLUNTEER CORPS, in preference to permitting the compulsory Clauses of the DEFENCE ACT to take effect. It is more respectable for the Inhabitants;—it is conformable to the wishes of the Legislature;—it marks the Loyalty, Spirit, and Zeal of the Parish in the Service of their Country;—and it is particularly *to be observed, that they will have the Privilege of serving together, under Officers chosen from among the oldest Inhabitants;—that they will not be drafted into any Regiment, Battalion, or Corps of Regulars, Militia, or Fencibles;—that they will not be called out of their District, except in case of actual Invasion, or the enemy appearing upon the Coast, and then not out of the Kingdom.* | Norbury, Printer. Brentford."—*By permission of Miss McNab, who has the original.*

Miss McNab has also allowed me to see a copy of a booklet containing the Rules of the "Kew Volunteer Infantry." On page 3 is a recommendation of the "Rules" over the signature of "John Haverfield, Chairman, P.T.", and then on page 4 there is "State of the | Company | of | Kew Volunteer Infantry. | Captain | Robert Browne | First Lieutenant | Robert Tunstall | Second | Lieutenant | William T. Aiton | Sergeants | T. Hofland, T. Healey, G.

Prior to the Volunteer movement taking shape at Kew the Militia Ballot would seem to have caused anxiety to the staff of gardeners, and the following document in McNab's writing (now in the possession of Miss McNab), whilst it is witness to young McNab's force by showing that already within two years of his arrival at Kew he was a leading spirit on the staff, has the further interest of an illustration of what must have been a not uncommon procedure in the existing state of the country :—

"Kew Gardens, 8th December 1802.

"We the undersigned have agreed to form a Society for the purpose of alleviating the burthen which would fall upon the individuals who may chance to be balloted to serve in the Militia. It is proposed that each member shall deposit Half a guinea (either all at once or as it may be convenient) in the care of a proper person whom the Society shall think proper to appoint. If any of the members are balloted the said money is to be applied to the purpose of hiring Substitutes as far as it goes; if not sufficient the person or persons whose misfortune it is to be balloted must make up the deficiency without any claim upon the Society. These regulations will be subject to any amendment the majority may think proper or may be relinquished altogether provided a better expedient can be found. Upon this consideration the present may be considered only as a proviso against the consequences that delay might be attended with :—William Kerr, William McNab, John Haddon, Christ. Bearpark, John Taylor, Harry Jones, John Snow, George Hurst, John Wheatly, Dun. Montgomery, Daniel Forrestill, John Fenn, Adam Taylor, Romeo Forbes." [1]

Pepper. | Rank and File | sixty | Fugel-man | Two Drummers | Two Fifes | Armourer." | Pages 5 and 6 are occupied by "The Engagement," as follows :— "That every Member of the *Kew Volunteer Company of Infantry*, now formed in the Parish of *Kew*, in the County of Surrey, doth freely and willingly engage himself to serve in the said Company of Volunteers, according to the terms of Service prescribed in the Defence Acts of George III., Chaps. 96, 120, and 121, namely, that whenever called upon by the Direction of His Majesty, he will voluntarily march to repel *Invasion*, or for the suppression of *Riots* and *Tumults*, according to the Provisions and Clauses in the said Acts, claiming and enjoying the Exemptions, Benefits, and Privileges therein provided ; and that he will faithfully conform to the several Duties, Rules, and Regulations hereby established, to which he subscribes his assent." Then follow the "Rules, etc."

[1] Perhaps the luck of the Ballot took away one of the staff and absorbed the funds of the Society, for amongst Wm. McNab's papers there is also this other document recording the institution of a new Society in little more than six months' time :—

"Kew Gardens, 18th July 1803.

"We the undersigned have agreed to form a Society for the purpose of alleviating the burthen which would fall upon the individuals who may chance to be balloted to serve in the Militia or the Army of Reserve. It is proposed that each member

The William Kerr[1] whose name heads the list of Members of the Society of 8th December 1802 was foreman of Kew Gardens at the time, but left Kew for China in 1803 and was succeeded as foreman by McNab. Scroll copies preserved by McNab of two letters[2] written by him to Wm. Kerr seem worthy of reproduction here alike for the interest of facts mentioned and as indication of the character of McNab himself :—

William McNab, Kew, to William Kerr, Canton.[3]

My Dear Friend,—As this opportunity offers I have taken up my pen to give you a few of the Particulars that has happened at Kew since you left it. Although there has nothing very interesting happened yet there is something which will Bring you in mind of the Old Place and your Acquaintance which you left Behind. (I shall Begin with myself first.) I still Continue in the same situation which I was Placed in when you left Kew. It would be unnecessary to say that there is a number of Difficulties attending it. But a man must make up his mind to Encounter these where ever he goes and Mr. Aiton has Behaved to me in every respect more like a Father than a Master.

He has had an addition to his Charge by the Death of Mr. Forsyth[4] late of Kensington who Died in August 1804, when His Majesty was Pleased to Appoint Mr. Aiton Gardener there Likewise, and Mr. John Aiton has the whole of Windsor Gardens to himself. He has Mr. J. Vace and Tidie under him the same as when you went away. All the Rest of that worthy Family are well.

There is no Particular alteration in the Botanic Garden since you went.

shall deposit the sum of Nine shillings entering and three shillings every week till the fund amounts to the sum of ten pounds to every member whose misfortune it is to be Balloted. These regulations will be subject to any amendment the majority thinks proper, or may be relinquished altogether provided a better expedient can be found :—William McNab, C. Bearpark, James Law, John Haddon, Robert Clue, Henry Jones, John Fenn, Edward Dare, Alexr. Morison, John Snow, John Taylor, Isaac Wadie, John Wheatly.

"Paid 6 Guineas to Mr. Bearpark, Augt. 15th. Began a New Club, August 20th 1803."

Does this concluding sentence indicate that the lot had fallen upon Mr. Bearpark ?

[1] William Kerr (—1814). See Britten and Boulg., Bibliog. Index. His name is preserved in the familiar garden shrub *Kerria*.

[2] Now in the possession of Miss McNab, by whose permission they are printed here.

[3] The scroll copy is undated, but intrinsic evidence fixes 1805 as the year of writing.

[4] William Forsyth (1737-1804). See Britten and Boulg., Bibliog. Index. Name preserved in the charming garden shrub *Forsythia*.

The Collection of Plants is greatly Augmented. The Collection of Seeds from the Late Mr. P. Good[1] (whose Death is so much Regretted) which was sown in the Spring Before you went away are doeing very well and all New to this Country.

There was a very Valuable Collection of Living Plants Collected in the Province of Cyanna, South America intended for the National Garden at Paris which was taken By Two English Privateers in August 1803 and Brought into this Country when His Majesty purchased them for Kew Garden. There was 129 Large Boxes and from 20 to 50 Plants in Each Box, of Course there was a number of them dead. But them that is alive has made a Great Addition to the Collection at Kew and the Most of them are New.

Besides the very Valuable Collection which you have honoured the Royal Gardens with, it would Be unnecessary for me to say anything Concerning them as I presume Mr. Aiton has given you a full account of them, I have only to say that they are doing very well; and every one is anxious that they should Flourish, For the Respect they owe to so worthy a Character as He who sent them.

There are many of your Acquaintance Left the Gardens and many New faces Come.

The old men in the Pleasure Garden are all much the same as usual. There is John Wheatly, Isaac Walker, Charles Aimer, John Colier, Romeo Forbes, John Fenn, Rd. Clue, Edward Dare, and Myself in the Garden that you know—John Haddon is Gardener to Lord Dundas in Yorkshire and is doing very well. John Taylor is Gardener to R. H. Rucker, Esqr., Near Wandsworth, Surrey, and is doing well. Duncan Montgomery is still with the Duke of Montrose. George Mackay is with Mr. Buchannan, Camberwell Nursery. James Archibald is still in His Place. Mr. Bearpark is gone to Colonel Bowman at Briton Hall Yorkshire to be Gardener; it is the same Place that William Allen went to from Kew who I am sorry to say is no more. Mr. R. Chandler is doing very well, He has plenty of business and He has a fine Boy about 18 Months old. Mr. Alexr. Richardson is still with Earl Tankerville. Mr. Dare, Mr. Morgan, and most of your other Acquaintance in the Garden are in the same way as when you left Kew.

I had almost forgot to mention that Mr. Snow Could not be Comfortable out of Russia so He went of to it in September 1803, where he still Remains and I Believe is doing well. I am sorry to say that Mr. Philipson who went to the . . . . is no more. David Edgar from Richmond Hill is gone to the Marquess of Bath Near Bath, He is going on very well. It is a much larger Concern than what he had before.

Your Cousin Mr. Millar has been at Kew this 18 Months as Foreman to Mr. Pepper. He is well, you will find a letter from Him in a Small Box of Annual Seeds which is sent on Board the Hope along with the Plants.

[1] Peter Good (— 1803). See Britten and Boulg., Bibliog. Index. Name preserved in the greenhouse shrub *Goodia*.

Mr. Hoffland and Mrs. Hoffland[1] are Both well and often Enquiring after you.

Mr. Addington and Mr. Ayton are still at Kew Palace in the same Capacity as they were. The Palace is still going forward But far from Being Finished.

I am,

Kew, April 29th 1806.

My Dear Friend,—As this opportunity offers I have taken up my pen to write you a few lines although I have got nothing very particular nor interesting, yet I thought it might be some satisfaction to hear from the Place where you have spent many an hour in; and the acquaintance that you have spent many an hour with. I wrote you last year when the Plants went which you have Received Before this Time I hope. In that letter I mentioned Every thing that I thought was worth mentioning since that period there is nothing very particular taken place.

Most of your acquaintance is at Kew that was at it at that time, and most of your other acquaintance which was gone Before that time are much in the same way as they were in then. I still remain at Kew yet. But does not expect to be here much longer, when I do leave I expect to go a little nearer you. But you will hear the first opportunity that offers after I leave.[2]

Everything in the Garden goes on much in the same way as usual. The Collections has been greatly increased lately with Seeds from N. Holland and with the Plants from you particularly with first Collection as they came in very good Preservation and are growing very fine. The last Collection (through bad management in Bringing home) was not in so good a state, but many of them are growing very well; but Mr. Aiton will mention the Particulars Respecting them in His letter.

I am sorry to say that Mr. Masson[3] (who has sent so many things to Kew) is no more. He died in Quebeck last winter.

Mr. Aiton and Mr. John A. and the rest of the family are all well, they are none of them married yet. Your old acquaintance Mr. Richardson is married, he married the Housekeeper at Lord

[1] The parents of Thomas Christopher Hofland (1777–1843), the landscape painter, who was Sergeant in the Kew Volunteers. In this connection young McNab and the other members of the Kew staff would come in contact with him. But it is probable that William McNab had a closer tie with him, and indeed may have been his first cousin. Miss McNab informs me that she has reason to believe that Elizabeth Whiteman, mother of Wm. McNab, was a sister of the Mrs. Hofland referred to in this letter and mother of the artist. Certainly there was a continuous close intimacy between the McNabs and Hoflands, and a portrait of Hofland, painted by himself, is now in possession of Miss McNab.

[2] There is no evidence as to what was in his mind at this time, but in correspondence with his brother John, who was farming in Ayrshire—Miss McNab has kindly allowed me to see the letters—McNab several times refers to his desire to leave Kew.

[3] Francis Masson (1741-1805 or 6). See Britten and Boulg., Bibliog. Index.

Tankervilles. He is going on very well. Mr. Chandler is very well and has two sons to Succeed him in the Business. Miss Page is married to Mr. Paine a Butcher at East Sheen. If you had any Claims there you are Behind.

Mr. Millar still Continues at Kew with Mr. Pepper. He is very well. I saw him this Evening. He desired his Best Respects to you and I was to say all your friends are well.

There has been several Great Men died within this 6 months in this Country. Mr. Pitt died about 3 months ago, and Lord Nelson was killed in an Engagement with the Combined Fleets of France and Spain off Cape Trafalgar. His Loss has Been very much Regretted in this Country.

It does not come within the limits of this Letter to give you a general account of the Changes which has taken place in the National affairs since you left the Country. It is sufficient to say that Mr. Fox and Mr. Windham and most of the old opposition members are come into office now, and great things are expected from them, But how they will turn out we must let time determine. Had I thought on it sooner I should have sent you a few of the News papers in the box with the Books which might have been some satisfaction to look over, but as it is too late now I must take another opportunity.

I should be very proud of a few lines from you when you have an opportunity and Remain Dear Sir

Very faithfully yours, &c.

Mr. Wm. Kerr,
Botanist,
Canton.

(Sgd.) WM. MCNAB.

Arrived in Edinburgh, McNab threw himself into his work with what enthusiasm and success we may learn from the following contemporary comments :—

"A new superintendent (Mr. MacNab) has recently been appointed, in the place of Mr. Somerville, whose death we mentioned in the Magazine for March last. Mr. MacNab has for many years been employed in the Royal Gardens at Kew, and has thus had great experience in the cultivation of exotics. Through the kindness of his botanical friends in the south, he has already introduced into the Edinburgh Garden many of the new and rare species of stove and greenhouse plants, which were never before cultivated here. Among these are a number of New Holland plants, particularly six species of Banksia, and two of the rarest of the Mimosa tribe."[1]

[1] Dr. Neill in *Scots Magazine*, LXXII (1810), p. 367.

"Mr. Macnab from Kew is doing wonders at our Botanic Garden here, if there was but funds for improvements."[1]

"The personal exertions of the superintendent, or head gardener, Mr. Macnab, we believe to be unremitting; and it seems a public disgrace that they should not be better rewarded, and that his abilities and zeal should not be seconded by a small grant of the public money for the improvement of the garden.

"Notwithstanding this discouraging state of matters, Mr. Macnab has lately introduced many new or very rare plants into the garden. He has, in particular, carried the culture of exotic aquatics to a pitch hitherto unknown in Scotland."[2]

"At present the Garden enjoys a most active and intelligent superintendent, Mr. William Macnab, who, notwithstanding the discouraging circumstance of the funds for maintaining the Garden being extremely inadequate, has contrived not only to keep up but to increase the collection of plants."[3]

Nor is foreign testimony to the same effect wanting. On page 38 of the third volume of "Itinéraire et Souvenirs D'Angleterre et D'Ecosse, 1814-1826, Paris, Imprimerie de Prosper Dondey-Dupré, rue Saint Louis, No. 46, au Marais, 1834, there is the following record :—[4]

"Du palais du Parlement nous sommes descendus par High Street au Jardin Botanique, dans le fond de la vallée qui separe Arthur's-Seat de Calton Hill. Sa fondation date de 1764. Le Parlement d'Angleterre et la ville d'Édimbourg se cotisèrent pour faire les frais de cet établissement, et subvenir aux dépenses de son entretien. Bien que le sol soit mêlé de sable et de gravier, les arbres les plus délicats et les plantes les plus frêles y prospèrent. Les Systèmes de Linné et Jussieu y ont chacun une école distincte; et de savants professeurs font de cours qui sont très-suivis. Le premier jardinier est à la fois instruit, soigneux, et passionné pour son art. Il surveille specialement la culture et la temperature des serres que l'on chauffe à la vapeur. En passant de leur atmosphère plus ou moins tiède à l'air extérieur souvent brumeux et glacial, il a presque entièrement perdu la voix. A peine l'entend-on parler; et c'est d'autant plus pènible pour ceux qui l'écoutent, car il s'exprime avec clarté et elegance. Cet accident dont son âge semble augmenter la gravité, n'a point affabli son amour pour les familles végétales placées sous sa tutelle. Le moindre des individus qui les composent y a des droits. Il les montre tous avec une sorte

[1] Patrick Neill to Sir J. E. Smith, 15th Feb. 1811.—*Smith Corresp.*, *Linn. Soc.*

[2] Dr. Neill in *Scots Magazine*, LXXIV (1812), p. 484.

[3] Dr. Neill, Essay on Scottish Gardens and Orchards, 1812, p. 101.

[4] I am indebted to Mr. A. P. Stevenson, Dundee, for this reference.

d'orgueil. . . . Notre guide a pour ses bruyères une prèdilection marquée. Il en possède une collection nombreuse. Quoiqu'elles soient égalment jolies, chacune a des droits particuliers à ses éloges. Quelle variété de découpures et de couleurs dans toutes ces petites corolles plus ou moins épanouies, éparses ou groupées sur les rameaux qui les portent, et parmi les épis de feuillage où les unes timides semblent se dérober, tandis que d'autres cherchent à en sortir afin qu'on les voie. Enfin, ici sont des myrtes en pleine terre et en espalier, là des arbustes indigènes ou exotiques. Une main amie protége l'enfance, la maturité, la vieillesse de toutes ces plantes, et s'attache à les préserver de l'influence d'un climat rigoureux."

The energy thus shown by McNab must have been an influential factor in bringing about the change which befell the fortunes of the Garden in a few years' time. The five acres to which the Garden was restricted was a small area in which to maintain such a representative collection of plants as the aspiration of the Principal Gardener now aimed at, and there was no prospect of an extension on the site because the surrounding land, hitherto occupied as nursery gardens, was being feued for building by the Heriot's Hospital Trust to which it belonged. So far back as the period of John Mackay's tenure of office as Principal Gardener expression had been given to a desire for a better site for the Garden, which, however, had not been satisfied.[1] When, therefore,

[1] Thus Dr. Patrick Neill, writing rom Edinburgh on 30th January 1832, under the pseudonym "Citizen," in a controversial pamphlet entitled "Where ought the New Cemetery to be placed?—In the Meadows? or in the King's Park?" says:—"I would suggest that some portion of the pasture-fields of the royal domain of Holyrood Palace,—one of the slopes, for instance, at the South-western base of Arthur's Seat,—should be appropriated to this sacred purpose. The whole domain is already in one sense a sanctuary; but the cemetery would truly deserve the name. Fifty or sixty acres, commencing about the Echoing Rock and the Powder Magazine, and extending in a westerly direction in the line of the foot path to Duddingstone (which would be turned a little to the south) to near the stile at Gibraltar House or the cottage which has now acquired the name of *Jeanie Deans' house*, would afford great variety of surface capable of every sort of embellishment, architectural and arboreous. In all places the soil would be dry. In some parts it would perhaps prove shallow; but the subsoil would certainly not be more difficult to penetrate than that of the Calton Hill. Against the ledges of rock which rise in various places, sepulchral arches and vaults, if such should be in demand, could be made to abut with great propriety. The space here pointed out would embrace to some extent the site selected, more than thirty years ago, by the late distinguished Mr. John Mackay, for a new Botanic Garden, which was then projected: for he included the Echoing Rock and the Wells of Weary (the latter now existing only in hallowed recollection, for they have unfortunately been annihilated by the Railway tunnel). I trust I may be permitted to assume, that a place chosen by so competent a judge for the site of a Royal Botanic

the dilapidated condition of the plant-houses, of which we have frequent mention in contemporary records, compelled the Government to give attention to the urgent representations of the need of capital expenditure upon them, the question of removal of the Garden to a better site was again raised, and, as we may conjecture, would be pressed with insistance by McNab.

The story of the negotiations and controversies in regard to this and of their ultimate issue will be told in the general account of the history of the Garden in a later number of these "Notes." For the purpose of this notice of William McNab it is necessary to say only that the movement for a new site was successful, and after the abandonment of one of nine and a half acres purchased in 1815 for a new Garden to the east of Holyrood Palace, an area of fourteen acres at Inverleith, which the Garden still occupies (with ground subsequently added), was acquired by the Barons of Exchequer, and thither the plants of the Garden in Leith Walk were brought during the years 1821 and 1822.[1]

The work which such a transference entailed could have fallen into no abler hands than those of William McNab, and we have evidence in abundance of his skill in disposing of plants in the open to the best advantage horticulturally and, at the same time, artistically, and also of the correctness of his conceptions in the designing of houses for plant-propagation. Some of these houses erected at this time are now in use, modified no doubt in details in accordance with improved methods, but in their main features having the form of the period of their erection. Some of the trees moved to the new Garden were of considerable size,

Garden is likely to be well adapted for an ornamental cemetery. The only objection to it as a garden was, that it would be rather too much exposed to wind: but this forms a strong recommendation in the other view. The yew, the Scots fir, and the Norway spruce (which in our climate must chiefly take the place of the cypress) would all flourish exceedingly in this portion of the King's Park; and the bay-laurel, the holly, Irish ivy, and other kinds of evergreen shrubs would likewise prosper well amid the tombs."

[1] It was in 1823, I think, that the last fragment of our Royal Botanical Garden was removed from its situation on the west side of Leith Walk, and that the transplantation of the whole to its present site at Inverleith was completed. No garden could be made to walk a mile with less injury to its health. Scarcely a single plant or tree was lost, and after recovering from their first sickness, they looked fresher and prouder than ever. Dr. Graham, the Professor, was a respectable botanist, and a good teacher, and in his first lieutenant, McNab, he had a most admirable practical man.—*Cockburn, Memorials*, p. 411.

and from McNab's notes which have been preserved we learn the dates of preparation of some of them in the old Garden, that of planting in the new Garden, and also the positions in which they were planted, and are thus enabled to recognise several of them, now stately specimens, in the Garden of to-day. His notes also give us particulars of herbaceous plants and shrubs, as well as of plants in pots, that were put in the new Garden.

The removal of such a collection of plants, and the formation of this Botanic Garden on a new site, gave McNab an unrivalled experience in transplanting[1] and planting shrubs and trees, both deciduous and evergreen, and the results of his experience with the last mentioned class he embodied at a later period in a pamphlet,[2] which, as it is difficult to obtain a copy—I have been endeavouring to find one for some years for the Library of the Royal Botanic Garden, and so far without success—and there is much sound advice in its pages, I have had transcribed from a copy in the Library of the University of Edinburgh, and print it as Appendix A to this narrative.

Established in the new Garden, McNab's further history is that of its Principal Gardener identified with its reputation alike for its collection of plants and their cultivation, and for the young practical gardeners trained in it. Most gardeners find an affinity in some group of plants which absorbs their interest more than do other groups. McNab was no exception, and was attracted in special degree by Heaths and plants which were then commonly called "New Holland Plants"—a class nowadays out of fashion and relegated to unmerited neglect by the crowd of easily-grown soft-wooded plants. The collection of these hard-wooded plants in the Royal Botanic Garden under McNab was renowned both for number of species and for size of specimens. In 1832

[1] In an article in the "Scottish Farmer and Horticulturist" for April 24, 1861, headed "McNab's Transplanting Machine," James McNab describes a machine which he says "was originally invented by my father, Mr William McNab, late Curator of the Royal Botanic Garden, where it has been in active operation for the last thirty-five years, with a degree of success not often witnessed."

[2] "Hints on the Planting and General Treatment of Hardy Evergreens in the climate of Scotland". By William M'Nab. Edinburgh, Thomas Clark, 38 George Street, 1830.

he gave to the world[1] the results of his experience in the management of Cape Heaths, and as this pamphlet is somewhat scarce, like his other publication already referred to, and may be reckoned still an authoritative work on the subject, I have added a transcript of it in Appendix B to this narrative.

It would have been strange had the excellent service of McNab as Principal Gardener failed to secure for him a recognition in the the way of salary and emoluments better than those for which he came to Edinburgh. Only in 1819 had his salary been raised, and then but from £50 to £60, and we find him driven therefore to present the following memorial, which gives interesting information as to practices current at its date :—

Unto the Right Honourable the Lord Chief Baron and Barons of Exchequer.[2]

The
MEMORIAL OF WILLIAM MCNAB,
Curator of the
ROYAL BOTANIC GARDEN, EDINBURGH.

Humbly sheweth

That the Memorialist before he came to his present situation was Foreman at the Royal Botanic Garden at Kew a situation of very great trust and which the Memorialist was so fortunate as to fill for eight years to the entire satisfaction of his superior Mr. Aiton head gardener, whose abilities and knowledge are well known, and who is entrusted not only with the gardens at Kew which are reckoned to contain the finest collection of Plants in Europe, but also with the superintendence of those of Kensington and some other of the Royal residences.

The Memorialist during the last five years he was at Kew had a salary of one hundred guineas per annum and a House firing and candles, and the use of an excellent Botanical Library with some other advantages, and as he was so fortunate as to possess the good

[1] "A Treatise on the Propagation and Cultivation and General Treatment of Cape Heaths in a climate where they require protection during the winter months." By William McNab. Edinburgh, Thomas Clark, 38 George Street, 1832. Of this work the Hortus Woburnensis says (p. 277)—" contains the most valuable instructions that has ever yet appeared in print on the subject, and ought to be in the hands of every cultivator or admirer of *Ericeæ ;* it is rendered doubly valuable by its coming from the pen of one who is generally known to be one of the best practical *Botanists* and most successful cultivators in Britain, and whose Heaths are actually grown to the size of small *trees*, and many of them all covered, from the edge of the pots to the extremity of the plants, with beautiful blossoms."

[2] Miss M'Nab has kindly shown me this Memorial and allowed it to appear here.

opinion of Sir Joseph Banks and some other distinguished Botanists he was entitled to expect when he left the Royal Gardens a more advantageous situation.

In 1810 the late Dr. Rutherford applied to Sir Joseph Banks to recommend a proper person to take charge of the Royal Botanic Garden at Edinburgh and in consequence of his recommendation the Memorialist was desired to become Curator of that garden and the Memorialist understood that some arrangements were likely to be made relative to the garden which would make it a desirable situation.

The Memorialist with this view came to the Edinburgh Botanic Garden for a salary of fifty pounds per annum with House fire and candle and two shillings and sixpence from each Botanical student, which on an average comes to from £14-£15 per annum.

The Memorialist has no ground or vegetables for his family use.

The Memorialist continued nine years at the above salary and last year he had an addition of ten pounds in consequence of a promise made to him by the late Professor and it may be mentioned that the Memorialist has had much more work personally to perform here than he had reason to expect on account of the small number of workmen employed. He has had to work hard with his own hands in order to keep the garden and the collection of plants in a respectable state in doing which being frequently exposed to sudden heats and colds in the Hot-houses he has materially suffered in health.

The Memorialist is also exposed to much unavoidable expence solely for the benefit of the garden and for which he has at present no means of being reimbursed, in entertaining in his own House various correspondents in the line of professional gardeners and those in similar situations and circumstances in life with himself who visit the garden and from whom the Memorialist receives important plants and seeds for the use of the garden and to whom some attention is therefore due. Altho this is done in the most economical manner yet it is very severely felt by the Memorialist. He would not be exposed to this expence were it not with the view of getting additions of plants and seeds for the garden, which the Memorialist can shew have been very considerable within these later years as well from the Books which he keeps in the garden for registering the plants and seeds which are received, as from the plants themselves which are now growing in the garden.

The Memorialist is also at considerable expence for Botanical Books which cannot be wanted in an establishment like this. These the Memorialist has to purchase at his own expence while in most similar situations which the Memorialist has visited a small Botanical Library is kept at the expence of the Establishment and where the Curator has no occasion himself to purchase botanical Books. In Oxford and Liverpool this is the case.

The Memorialist has a large family to provide for and he finds that on his present income he cannot give his children the education which his situation in life would seem to demand.

The Memorialist has no means of knowing the salary and other advantages which other Botanic Gardeners may have in various parts of the Kingdom. He knows however that the Curator of the Botanic Gardens at Liverpool has 175 guineas per annum as salary with house firing and other advantages.

The Curator of the Botanic Garden at Glasgow has £90 per annum with a promise of an advance a house and a piece of ground for growing vegetables for his family and five shillings from each student who may attend the Botanical Class.

The Memorialist understands that the Curators both of the College Botanic Garden and of the Glasnevin Botanic Garden at Dublin have upwards of £150 per annum.

On these grounds the Memorialist earnestly entreats that the Right Honourable the Lord Chief Baron and Barons of Exchequer will take his case into consideration. He relinquished a situation in which he had 100 guineas per annum when he accepted that of Curator of the Botanic Garden. It is both more laborious and more expensive and he has never drawn above £80 per annum, many years less. He therefore trusts that he will receive such an increase of permanent income as shall be thought reasonable in the circumstances of the case.

WILLIAM MCNAB, Royal Botanic Garden, Edinburgh.
13th January, 1820.

The Memorial is endorsed by Sir Joseph Banks, Mr. William Aiton of Kew, and supported by Mr. Kennedy of Dunure; and Prof. Graham, who had succeeded Prof. Rutherford (who died Dec. 15, 1819) as Regius Keeper, wrote in support of it at a later date, namely 14th March, 1820. It met with a favourable response. The salary was raised to £80 in 1820, and to £100 in 1822. In 1834 a further advance to £150 was given.

Tradition required that the Principal Gardener of the Edinburgh Garden should have an acquaintance with the plants of the Scottish flora. Part of his duty was the provision of specimens for the Professor's courses of instruction to University and other students in the Garden, and the wild vegetation of the neighbourhood would have to be laid under requisition for many of these in the quantities required. And then he also accompanied the Professor upon his botanical excursions with pupils as a coadjutor in guiding and instructing the students, and also as a collector of plants to add to the stock in the Garden. We have seen that McNab's immediate predecessors were, all of them, keen botanists and collectors, and he proved to be in no way behind them in his interest in the flora of Scotland. I have often heard my father speak of the enthusiasm with which

McNab pursued the search of the rarer plants on the hills of Scotland, of his untiring energy, and of his helpfulness to the young students eager to learn ; and the regard in which he was held by those who were associated with him found tangible expression in a gift from some of those who had accompanied him on such expeditions. The occasion was in 1834. Prof. Graham, having with him McNab, had made excursions to Clova in 1831, to Sutherlandshire in 1832, and again to Clova in 1834, and several of those who had been at one or other or all of the excursions initiated the proposal of a testimonial to McNab.[1] The list of subscribers is an interesting one, containing names that are now familiar to all botanists as of those who have done sterling service to Botany, and I make no excuse for including it here. It runs :—

John Hutton Balfour.[2]
Martin Barry.[3]
William Brand.[4]
Hugo Tod Spalding Beveridge.[5]
William Hunter Campbell.[6]
Edward Charlton.[7]
William Christy.[8]
E. B. Field.
David Graham.[9]
Robert Graham.
Joseph Dalton Hooker.[10]
Thomas Ivory.
James Macaulay.[11]
John Melrose.

[1] "We understand that on the last night of the year a few young botanists gave a supper in Menzies' Tavern to Mr. William McNab, the talented and worthy superintendent of our Botanic Garden, and presented him on the occasion with a handsome piece of plate, in the shape of a toddy-jug, bearing an inscription expressive of their esteem for him and of their gratitude for his uniform kindness and assistance to them during their various excursions with Professor Graham among the Scottish Alps."—*Edinburgh Evening Courant*, Monday, January 5, 1835.

[2] John Hutton Balfour (1808-84). Regius Keeper of the Royal Botanic Garden, Edinburgh, and Professor of Botany. Orig. Memb. Bot. Soc., Edin.

[3] Martin Barry (1802-55). M.D. Edin. 1836. Embryologist. Orig. Memb. Bot. Soc., Edin.

[4] William Brand (1807-69). W.S. Orig. Memb. Bot. Soc., Edin.

[5] Hugo Tod Spalding Beveridge, M.D. Edin. 1841.

[6] William Hunter Campbell (1814-53). Lawyer in British Guina. Orig. Memb. Bot. Soc., Edin.

[7] Edward Charlton (1814-74). M.D. Edin. 1836. Prof. of Medicine, University of Durham. Orig. Memb. Bot. Soc., Edin.

[8] William Christy (d. 1839). Botanist in S. England.

[9] David Graham and Robert Graham. Sons, I believe, of Prof. Graham.

[10] Joseph Dalton Hooker, G.C.S.I., O.M. The only survivor. Nestor of Botanists.

[11] James Macaulay, M.D. Edin. 1838. Practitioner in London.

Giles Munby.[1]
Richard Parnell.[2]
James Ramage.
William Alexander Stables.[3]
James Stewart.[4]
Nicholas Tyacke.[5]
George Charles Wallich.[6]
Hewett Cottrell Watson.[7]
Robert Wight.[8]

That McNab should thus evoke the goodwill of young students as well as of older botanists with whom he journeyed on excursions, often in trying circumstances, is telling testimony to his capacity and personal worth.[9]

[1] Giles Munby (1813-76). Algerian Botanist. Orig. Memb. Bot. Soc., Edin.

[2] Richard Parnell (d. 1882). M.D. Edin. 1835. British Agristologist. Orig. Memb. Bot. Soc., Edin.

[3] William Alexander Stables. Naturalist in North Scotland.

[4] James Stewart. Orig. Memb. Bot. Soc., Edin.

[5] Nicholas Tyacke (1812-1900). M.D. Edin. 1836. Practitioner in Chichester. Orig. Memb. Bot. Soc., Edin.

[6] George Charles Wallich (1815-1899). M.D. Edin. 1836. Marine Biologist. Orig. Memb. Bot. Soc., Edin.

[7] Hewett Cottrell Watson (1804-1881). Botanical Geographer.

[8] Robert Wight (1796-1872). M.D. Edin. 1816. Indian Botanist.

[9] Here is McNab's letter of acknowledgment :—

Royal Botanic Garden,
Edinburgh, Feby. 14th, 1835.

Sir,—I have taken the liberty of acquainting you that I have this day received from Messrs. Mackay and Cunningham the *Toddy Jug* with the addition put to the inscription of the names of those gentlemen who have conferred on me this high honour, and also an appendage to the Jug of a very handsome *Toddy Ladle*.

Permit me through you to express to those gentlemen my sincere and warmest thanks. When I accompanied you and the other gentlemen in the excursions to the North I was only performing part of my duty, and to have merited in any way their approbation was quite as much as I could have expected, but I am quite at a loss for words to express my gratitude for this distinguished mark of kindness. I can only say that I thank you most truelly, and should it ever fall to my lot and be in my power to be of use to any one of the party, my service will be most freely at their command, and may long life and prosperity attend you all, shall ever be the earnest wish of,

Sir, With the Greatest Respect,

Your Obedient Humble Servant,

(Sgd.) WILLIAM MCNAB.

To Dr. Balfour.

Busy man though he was, McNab evidently found time to carry on, like other collectors of the period, an exchanging correspondence with Mr. N. J. Winch, as we learn from two letters, now in the Winch Correspondence at the Linnean Society, which I add here by permission of the President and Council; but from their tenor we may gather McNab found that the demands made upon his time and energy by other avoca tions only allowed of fitful interchange. The letters are, how ever, interesting as showing that McNab was no merely empirica gardener.

William McNab to N. J. Winch.[1]

Botanic Garden, Edinr., 13th April, 1818.

Sir—In April 1816 when I had the pleasure of receiving a letter from you, I was at that time much engaged with the concerns of the garden, which prevented me attending to its contents at the time, and soon after I got into a very bad state of health which for a long time prevented me even from attending to the necessary affairs of the garden. I am however now thank God, got pretty well again, and I have now sent you a few specimens which you will receive with this, I am sorry to say that you will find but few of those mentioned in your desiderata list, however they are all that I can at present furnish you with, you will find a considerable number of Grasses, and some other chiefly Foreign Plants, which I hope at least a part of these will be acceptable to you.

I have to return you my best thanks for the Copy of your Northumberland Flora, which you had the goodness to send me, on the other side is a list of a few plants, which I wish specimens of, if you can furnish me with any part of them I shall be particularly oblidged to you for them.

As I have not hitherto pay'd any attention to the Cryptogamia, and have none of them in my Herbarium, I shall be particularly obliged to you if you could send me a few, if ever so common, of the *Musci*, *Hepaticæ*, and, *Algæ*, and what I have from you I know I may depend on being correct; and I shall endeavour to make you a suitable return so far as is in my power,

and I am, Sir,

Your very Humble Servant,

(Sgd.) William McNab.

[1] Printed by permission of the President and Council of the Linnæan Society.

Wm. McNab Desiderata List.

Schœnus Mariscus
Scirpus pauciflorus
Bromus racemosus
Radiola Millegrana
Chironia pulchella
„ littoralis
Ribes spicatum
Pyrola minor
Rosa scabriuscula
Orchis Morio
Ophrys muscifera
„ apifera
Malaxis paludosa
Cypripedium Calceolus
Zannichellia palustris
Myriophyllum spicatum
Equisetum fluviatile
„ limosum
Aspidium lobatum
Cyathea dentata
Schœnus fuscus
Scirpus carinatus
Alopecurus fulvus
Festuca decidua
Holosteum umbellatum
Polycarpon tetraphyllum
Centunculus minimus
Statice reticulata
Scheuchzeria palustris
Bartsia alpina
Limosella aquatica
Carex Davalliana
Aspidium fontanum
„ spinulosum
Asplenium alternifolium
Cyathea incisa

William McNab to N. J. Winch.

Botanic Garden, Edinr., 28th June, 1823.

Sir,—I rec'd yours of the 31st May, but having had so much to attend to since that I really have not had time to pay much attention to your request, however I hope I shall be able to help you to a few of the Saxifragæ that you want, so far as I am able to judge I think Mr. Donn's Monograph is the best on the Genus I have seen—but in a genus like *Saxifraga* where there are so many garden made species, it must always be difficult to clear up,

and I am, Sir,

Your very Humble Servant,

(Sgd.) William McNab.[1]

[1] To the end of his life McNab was a keen collector of plants, especially those of interest horticulturally. I find in a notebook—which Miss McNab has kindly presented to the Botanic Garden—of records of plants added to the Garden the following note of "Roses collected with Mr. Sabine, 14th October 1845" :—

Rosa canina : or new sp.
„ *villosa*
} in a field south side road opposite Red Hall.

„ *Donneana*
„ *heterophylla*
„ *sp.* near last
„ *spinosissima*
} on bank north side of road going down to Red Hall Barley Mills in wood below the road.

„ *tomentosa*
„ *villosa*
} at corner of clump of trees west from Sclateford and below last.

„ *sp.* like *canina*
} on footpath between Red Hall Barley Mills and Sclateford.

We obtain some idea of the general respect which William McNab inspired and of the esteem in which he was held from the demonstration in his honour which took place in 1844. The following circular shows its initiation :—

M'NAB TESTIMONIAL.

AT a preliminary Meeting, held here on the 24th July, of Gentlemen interested in the promotion of Botany and Horticulture, it was unanimously agreed, That to Mr WILLIAM M'NAB, the distinguished Curator of the Edinburgh Royal Botanic Garden, this country is especially indebted for the eminent progress which it has made in the science and practice of Gardening.

More than thirty years ago, Mr M'NAB was called to Edinburgh from the Royal Gardens of Kew, where, under the eye of his Majesty George III. (who took a warm interest in his labours), he held a similar charge. When it became necessary to transfer the Botanic Garden to its present locality, Mr M'NAB displayed remarkable skill in his arrangements for that purpose—particularly in the successful removal of trees, shrubs, and plants, to their new situation—some of them of large size, and probably 100 years old. During his whole career, Mr M'NAB has pursued a steady and unobtrusive course of observation and experiment, with regard to the rearing of Exotics from all quarters of the globe; and that he has been pre-eminently successful in this department, the Botanic Garden, in its present state, furnishes ample proof. He has also, by useful publications (particularly those on the cultivation of Cape Heaths, and the Transplanting of Evergreens), made known to others both the nature and results of his practice; and his numerous pupils have not failed to disseminate widely the lessons they were taught. Indeed, by the strict order and undeviating regularity which he has ever both displayed and enforced, Mr M'NAB may be said to have organised a new school of Practical Gardeners; while his kindly encouragement of merit, wherever it appeared among his assistants, and his unwearied attention to every request for advice or aid, whether from operative or amateur Horticulturists, has made him as universally esteemed as he is extensively known.

It was therefore proposed, and cordially responded to, that a Fund should be raised, by general subscription, with the view of presenting to Mr M'NAB such a Testimonial of gratitude for his

Rosa Borrerii —roadside near Hale.
,, *villosa?* —between Hale and Collington.
,, *involuta* —Collington Churchyard.
,, *villosa?* —by side of mill-lead near Coltbridge.
,, *rubiginosa*, ,, *villosa* —Caroline Park and Cramond.

and then collected on 19th October 1845 :—

Rosa new sp. —roadside near Dryden Burying-ground.
,, *caesia?* —south end of coal-pit near Cockpen Church.
,, *arvensis* —from Tynningham woods (received from Mr. Sabine).

valuable services, and of respect for his very estimable character, as may both cheer himself in his declining years, and excite others to pursue the same honourable path which he has trod—by shewing that meritorious labours, even in one's ordinary vocation, seldom fail of being sooner or later duly appreciated.

Until the amount of Subscriptions be known, it is, of course, premature to decide finally as to the most suitable mode of applying them; but the names of those who have agreed to act on the Central Committee, afford a sufficient pledge that this subject will be maturely considered. It may, however, be stated as the present view of the Committee, that, besides some complimentary offering, which may be handed down in his family, Mr M'NAB should receive a *more substantial* mark of esteem, in such form as the Committee may devise. It is also intended, after the procedure is closed, to print a brief statement of it, with a List of Subscribers, &c., of which a copy shall be transmitted to each, so as all who join in the object may possess a permanent record of it.

It may be proper likewise to observe, that, as the Subscription is not restricted to any country or class, so every one will be left to exercise his own discretion with regard to the sum he shall contribute. The willingly offered mite of the most humble labourer in Nature's field will be equally acceptable, and equally appreciated, with the ampler donation of the noble and wealthy amateur; for the gentleman whom it is designed to honour, has worked his own way to distinction, and all may appropriately unite in bearing testimony to that usefulness which never exempted any from its operation.

CENTRAL COMMITTEE.

Honourable Lord Ivory.
Honourable Lord Murray.
Sir George S. Mackenzie, Bart.
Sir James Gibson-Craig, Bart.
Sir Henry Jardine, Kt.
William Gibson-Craig, Esq., M.P.
Professor Christison.
Professor Dunbar.
Professor Graham.
Professor Miller.
Professor Syme.
Professor Traill.
David Anderson, Esq., of Moredun.
Isaac Anderson, Esq., S.S.C.
William Ballantyne, Esq., Dalkeith.
William Brand, Esq., W.S.
Rev. Dr Brunton.
Charles Cobbold, Esq.
George Dunlop, Esq., W.S.
John Gray, Esq., Greenock.
James Greig, Esq., W.S.
Dr R. K. Greville.
Thomas Handasyde, Esq., Nurseryman.
Eagle Henderson, Esq., Nurseryman.
Henry D. Hill, Esq., W.S.
Dr T. C. Hope.
Holmes Ivory, Esq.
William Keith, Esq., Accountant.
Charles Lawson, Esq., Nurseryman.
George Logan, Esq., W.S.
Mr Charles M'Intosh, Dalkeith Park.
Dr Douglas Maclagan.
John S. More, Esq., Advocate.
Stewart Murray, Botanic Garden, Glasgow.
Patrick Neill, Esq., LL.D.
William Richardson, Esq., Nurseryman.
Edward Sang, Esq., sen., Kirkcaldy.
Dr William Seller.
C. H. J. Smith, Esq., Garden Architect.
Andrew Symington, Esq., Merchant.
Captain Tait, R.N.
Thomas Thomson, Esq., W.S.
James Wilson, Esq., Woodville.
Alexander Wright, Esq., Nurseryman.

Treasurer to Committee,—MR WILLIAM BRAND, W.S., 4 QUEEN STREET.

NOTE.—*Communications may be addressed to the Treasurer, or to Mr Sang, Mr M^c Intosh, Mr Smith, or Dr Neill—each communication having the Letters M. T. written above the Address on the outside.*

Intending Contributors are respectfully requested to transmit their Subscriptions, if convenient, along with their reply to this Circular, or soon afterwards, as it is intended to present the Testimonial in December next.

EDINBURGH, 29*th August* 1843.

A ready response was given to the proposal of the circular, and on the 14th March, 1844, a "Presentation Dinner" took place in the Café Royal, Edinburgh, under the presidency of Professor Traill, supported by many distinguished citizens. The speech of the Chairman and Mr. McNab's reply on the occasion are cited here from the *Edinburgh Evening Courant* of 14th March, 1844. Professor Traill said :—

"I have now come to the toast of the evening, and, in introducing it to your notice, I do not consider that it is necessary to make many observations. When we turn to our worthy friend who sits at my right hand, we cannot but congratulate him on the number and respectability of those who have met here to do him honour. I might say a great deal about Mr. McNab, but I know that his character and his merits are so well known, and so justly appreciated by you, that I do not require to point them out or to dwell upon them. A short history of our excellent and esteemed friend may not, however, be uninteresting to this meeting, nor uninstructive to those who would attain to the same eminent position which he holds. To trace the successive steps by which he rose to that place will serve to show what may be accomplished by indomitable perseverance, well directed industry, and unbending integrity, and may prove an example to others to follow in his footsteps."

After a summary of the chief incidents in Mr. McNab's life, of which an account has been given above, Professor Traill continued :—

"It is well known with what zeal and talent he discharged the duties of his situation, and one consequence of his too assiduous attention to these was his catching a severe cold, by which he lost his voice. It is owing to his skill and industry we are indebted for the successful transplanting of so many beautiful exotics. It is owing to him that our conservatories are now so full of the plants of other countries, and it is owing to him that Scotland has attained such a high name for its scientific horticulture. It is unnecessary for me to enlarge on what you all know so well, and so much better than myself. I will only observe that Ayrshire, which owes its glory to Burns, will have another wreath in her chaplet in the fame of McNab. I have now the agreeable duty to perform of presenting, in the name of the subscribers, the testimonials now lying before me. In the first place, we considered that it would be better that this mark of their regard should not only be valuable, but useful, and we accordingly have to request your acceptance of a draft for £400 on the Edinburgh and Glasgow Bank, enclosed in this silver snuff box. This other snuff magazine which I hold in my hand, fashioned into the form of a thistle, is from the root of a Scottish bamboo, grown by Mr. McNab in the Botanic Garden. The cane from which it was taken grew forty feet in six months, which may give some idea of what Mr. McNab can accomplish. I will ask Mr. McNab to take a snuff out of it, and hand it round for the inspection

of the company. The committee also thought it would be becoming that Mrs. McNab should participate in some measure in the testimonial, and they have conceived it proper that that lady should be presented with this silver salver, silver divider, and silver sugar basin. There is another member of Mr. McNab's family to whom the committee feel deeply indebted. This is Miss McNab—the limner of that beautiful portrait of her father, which is now before you, and a copy of which is to be presented in an engraving to every contributor. As a work of art this portrait does great credit to the talented artist. This work-box, which bears an appropriate inscription, Mr. McNab will, therefore, do us the pleasure to present to his daughter. In conclusion, I crave a bumper to the health of our excellent friend."

Mr. McNab, on rising, said—

"Professor Traill and gentlemen, you can easily conceive what my feelings must be, and how unable I am to give expression to them. You have done me an honour which I never expected, and of which I feel I am altogether unworthy. Fain would I give utterance to the emotions of this moment, but it is quite out of my power to do so. I have never been trained to public speaking, and, to make the matter worse, I have little voice left; but even if I were still possessed of the same powerful organ I once enjoyed, I could not have said anything, for the moment I begin to hear the sound of my own voice, everything flies out of my head. Your excellent chairman has been pleased to say a great deal more of my merits than they deserve. I, for my own part, have never been able to see that I have done anything more than my duty. It is true that I know the names of a great many different plants, and also know how to cultivate them, so as to make them thrive in this climate. But yet I have not learned this: how to tell a species from a variety, nor how to distinguish betwixt one genus and another. It is very true that there is a plant which has been named after me,[1] but this did not take place from any merit of mine as a botanist, though I believe it was done out of a compliment to my wanderings amongst the wilds and mountains of Scotland, when making, along with the Professor and his young friends, botanical excursions, and certainly these were not very trifling, for their range extended from Cape Wrath to the Mull of Galloway. Besides, even if my education and talents had fitted me to be a botanist, I feel I could not have entered on that field without treading on ground belonging to my superiors, which is an interference no good subject should be guilty of. For the last forty-three years I have had a considerable deal to do in recommending persons to situations of responsibility both as head gardeners and under gardeners, and my invariable advice to them has been to serve their employers well and faithfully, as being the best way to serve themselves, and in the event of their not succeeding to please, to leave the situation as soon as possible, and on such terms as would still retain them the good feeling and friendship of their employers. I have been told that every master

[1] *Macnabia*, a monotypic genus of Ericaceæ in South Africa, was named by Bentham in 1839.

whom I served during the last forty-eight years, who is still in life, has his name inscribed in the list of contributors to the splendid testimonial presented to me. This shows that I have acted on the advice which I have given to others. I am afraid to say more, but would willingly address a few words to my younger brethren on a point which my experience has given me some means of forming a judgment upon. We are all aware of the prodigious improvements which have within these few years taken place in every sphere of knowledge and business. The art of gardening has not stood still, but has progressed at railway speed, and now we have a vast number of publications constantly issuing from the press for the instruction of the scientific and practical gardener. It is said that this knowledge will enable the rising gardeners greatly to excel their predecessors, and also save them a great deal of toil and study formerly required. I warn my younger brethren against being misled by such ideas. Theory is all very well, but I can assure my young friends that they can never rise to eminence without studying as diligently and working as hard as we have done. We have now a considerable deal of knowledge as to the nature and properties of our soil and climate, but notwithstanding the numerous weather prophets and almanac-makers of our time, I never yet met with a man who could tell me what sort of a day we were to have to-morrow, or even in the course of a few hours. Now, gentlemen, I will say no more, but be assured that I feel most deeply your kindness and generosity, and as long as life lasts and memory remains, the proceedings of this day will never be effaced from my recollection."

Strenuous in the discharge of his duties in the Royal Botanic Garden, William McNab died there in harness on 1st December, 1848, when nineteen months short of three score and ten years, and after a service to it of thirty-eight years as Principal Gardener. He was buried in the new Calton Burying Ground beside his wife, who had predeceased him by four years.[1]

In the *Edinburgh Evening Courant* of 16th December, 1848, is to be found an account of the tribute to his worth expressed at the annual winter meeting of the Caledonian Horticultural Society, of which Society he was a corresponding member, as he had been, since 1820, of the similar society in London.

From 1825 he had been an associate of the Linnean Society of London. He was also an associate of the London Medico-Botanical Society, and one of the founders of the Edinburgh Botanical Society in 1836.

[1] The grave is situated about the middle of the area and is marked by a headstone inscribed: 1834 | The Burying ground of | William McNab | Royal Botanic Garden | —In memory of | Margaret McNab | daughter of William McNab | who died 11 June 1834 age 22 years | Elizabeth Whiteman | wife of William McNab | died 25 September 1844 aged 66 years | William McNab | Curator of the Royal Botanic Garden | died | December 1848 aged 69 years.

In 1826 he was the recipient of a compliment from the Tsar, the nature of which the following letter [1] explains :—

London, 16–28 January 1826.

"The Russian Ambassador having considered it his duty to inform his Court of the readiness with which Mr. McNab facilitated to Dr. Fischer the means of fulfilling the commission with which he had been entrusted in this country in the year 1824 relative to the acquisition of plants for the Imperial Botanic Garden at St. Petersburgh, and of the contributions so obligingly made in order to enrich the Professor's collection for that Establishment, has been directed to transmit to Mr. McNab a diamond ring which his late Sovereign—the Emperor Alexander, of glorious memory, had been pleased to destine for him, as a testimony of His Imperial Majesty's particular satisfaction."

Hardy and active, William McNab appears throughout his long service in Edinburgh to have been able, with but little interruption from illness, to fulfil his duties in the Royal Botanic Garden, and this notwithstanding the handicap of an affection of his voice which an asthmatic attack had inflicted upon him, and to which reference has already been made (see page 315). For more than twelve months previous to his death he suffered from lameness, the result of an accident, and during the latter part of this period he was assisted in carrying on the work of the Garden by his youngest son Thomas.[2]

[1] Printed by permission of Miss McNab from the original official document in the possession of Mr. William McNab, Montreal.

[2] As the following letter tells:—

Royal Botanic Garden, Edinburgh,
9th January, 1849.

I have had the pleasure of being acquainted with Mr. Thomas McNab for some time during which I have had many opportunities of observing his excellent acquirements and the zeal and ability with which he discharged the duties committed to him. In a period of ten months he assisted his father in the Botanic Garden here, and for some months before his father's death he had the principal charge of the practical arrangements, and he acquitted himself entirely to my satisfaction. He gave me very able assistance during my course of lectures last summer, and he prosecuted the study of Botany with assiduity and success.

He has devoted his attention in a particular manner to Agriculture. While in the service of the Assam company he enjoyed opportunities of observing the cultivation of plants in India.

He possesses regular business habits, and his deportment has been at all times respectful and pleasing.

From all I know of his talents, his scientific information, his knowledge in business and his moral conduct, I consider him well qualified for the office of Factor for which he has announced himself as a candidate.

(Sgd.) J. H. BALFOUR, M.D.,
Professor of Medicine and Botany
in the University of Edinr.

—*By permission of Miss McNab from the original letter now in the possession of Mr William McNab, Montreal.*

The portrait I am able to attach to this notice is from a photograph in the possession of William McNab's granddaughter, to whose kindness I am indebted for the privilege of having a copy from which our reproduction has been made. Miss McNab writes—"I send you herewith one of the copies of the old photograph of William McNab which Moffat has done for us. I think it has lost a little in the process. I showed this portrait to some friends who could remember my grandfather, and they thought it was not 'austere' enough looking. Certainly the eyes are not so keen as in the old faded original, but I think the likeness is better than the engraving from the chalk portrait by my aunt Mrs. Jackson." Unquestionably the portrait reproduced here gives one an impression of the strong character of the man better than that obtained from the copy of Mrs. Jackson's drawing.

William McNab married, when he was at Kew, probably in in 1808, Elizabeth Whiteman (d. 25th September, 1844), third daughter of Joseph and Judith Whiteman, London, and had a family of nine children.[1]

Of this family, the oldest son James, who was born in 1810, prior to McNab's appointment to Edinburgh, succeeded his father in the Royal Botanic Garden, and is second only, if that, to his father in horticultural renown. Of him mention will be made hereafter in these "Notes."

The second son, William, settled at Geelong, in Australia, where he must have taken part in public life, for we learn from an advertisement in an Australian paper that he was Secretary of the Barrabool District Road Trust. He died in Australia.

The third son, Gilbert, born 20th November, 1815, at Edinburgh, graduated M.D. of the University of Edinburgh in 1836, submitting a thesis "On the Botany of the Coast of Forfarshire."

[1]Catherine Mary—*b.* Richmond, Surrey, 13th Feb., 1809; *d.* 1857.
James—*b.* Richmond, Surrey, 25th April, 1810; *d.* Edinburgh, 19th Nov., 1878.
Margaret—*b.* Edinburgh, 10th March, 1812; *d.* 11th June, 1834.
William—*b.* Edinburgh, 10th Dec., 1813; *d.* Australia.
Gilbert—*b.* Edinburgh, 20th Nov., 1815; *d.* St. Ann's, Jamaica, 21st Jan., 1859.
John—*b.* Edinburgh, 1st Sept., 1817; *d.* Edinburgh, 21st August, 1818.
Elizabeth—*b.* Edinburgh, 23rd May, 1819.
Jennet—*b.* Edinburgh, 10th Feb., 1821.
Thomas—*b.* Edinburgh, 4th January, 1824; *d.* Canada.
—Compiled from data furnished by Miss McNab.

He was an active botanist, and, after acting as assistant in the laboratory of Professor (afterwards Sir Robert) Christison, he went in 1838 to Jamaica, where he took up medical practice at St. Ann's.[1]

From Jamaica, Gilbert McNab sent to Britain considerable collections of dried plants. He died in Jamaica on 21st January, 1859.[2]

Thomas, the youngest son, was in Assam in early life, and, as we have seen, had returned at the close of his father's life. He subsequently settled in Canada, and his descendants are now prominent citizens in Montreal.[3]

[1] The following extract from the *Edinburgh Evening Courant* of 30th December, 1837, tells of a pleasing ceremony in Edinburgh before he left :—

DR. GILBERT MCNAB.—This excellent young man, we find, is about to leave Scotland, and to settle down a medical practitioner in Jamaica. In contemplation of this circumstance he was invited by the resident members of the Edinburgh Botanical Society to meet them at supper in Barry's Hotel on Wednesday last, 27th ulto. Professor Graham, President of the Society, was in the chair ; Professor Christison, one of the vice-presidents, acted as croupier, and besides a large proportion of the resident members, several of Dr. McNab's friends, not members of the Society, were present, anxious to pay any compliments in their power to one so universally respected. The party was therefore a very large one, and among them were Mr. Lindsay Carnegy, Dr. Neill, Dr. Walker Arnott, Dr. Greville, Dr. Peebles, and many other individuals whose greetings upon this occasion were as honourable, as they must have been gratifying, to him in whose success in life they had come, some of them from a distance in the country, to express an interest. In the course of the evening the progress of Dr. McNab, even from his boyhood, was traced, and unanimous testimony borne to the fact that in no situation as a schoolboy, as a pupil of the University, a candidate for his Degree, an assistant in the Clinical Wards of the Infirmary, a most efficient member of the Botanical Society, a son, or a friend, had he ever made, in a matter of the smallest consequence, one false step. Dr. McNab will leave the country assured of the warm attachment of a large body of friends, who entertain the most sanguine anticipation of his speedy advancement to great professional eminence and to merited scientific repute.

[2] A short biographical notice of Dr. Gilbert McNab appears in the Trans. Bot. Soc. Edin. (1860).

[3] The following testimonial shows that in Canada his aspirations were horticultural:—

Royal Gardens, Kew,
Oct. 5th/71.

I have great pleasure in stating that I was well acquainted with Mr. Thomas McNab in his youth, when myself a resident in Edinburgh and doing duty daily in the Royal Botanic Gardens there as protempore lecturer for the late Professor Graham (Prof. of Botany). At that time Mr. McNab's father was Curator of the Gardens and himself a young man of industry, ability, and good understanding, of excellent moral character, and under training of his father for the practice of gardening, especially landscape gardening.

I have reason to believe that Mr. Thomas McNab did full justice to his father's

Of the daughters, Catherine, the eldest, published in 1850–51 a book on "Botany of the Bible." The youngest, Janet, who made the sketch from which was taken the only portrait hitherto published of her father, married Mr. George Jackson, nurseryman, a member of the firm of Messrs. Thomas Jackson & Sons, of Kingston-on-Thames.

The esteem in which William McNab was held survived his death and found expression in a proposal to erect in the Botanic Garden a monument to him. The following is a copy of a circular issued in connection with the scheme :—

At a Meeting of a few Friends and admirers of the late Mr. William McNab, of the Royal Botanic Garden, Edinburgh, it was unanimously resolved, That a Subscription be set on foot for the purpose of erecting a Monument to his memory,—to be placed among the living monuments of his skill and industry, in the Garden where he so long and so successfully laboured,—should permission be granted to do so.

Mr. McNab's merits as a Gardener and a Botanist were so universally known and appreciated, that it is unnecessary to dwell upon them here ; while the high estimation in which he was held by all who enjoyed the pleasure of his acquaintance, and especially by his Professional Brethren, by whom he was long and justly regarded as the Father of the Profession,—fully warrants the hope that the present proposal will be cordially responded to.

Until the amount of Subscriptions be known, it will of course be premature to decide finally upon the nature and extent of the proposed Monument ; but the names of the Gentlemen who have already agreed to act on the Committee, afford a sufficient guarantee that the views of the Subscribers will be carried out in the most appropriate manner.

Interim Committee.

Professor Balfour.
Professor Pillans.
Professor Traill.
Professor Fleming.
Dr. Neill, Canonmills Cottage.
Dr. Greville, 33 George Square.
John Ballantyne, Dalkeith.
John Carstairs, 8 Howe Street.
Hew Crichton, S.S.C.
William R. Dickson, 1 Waterloo Place.
William Girdwood, 2 Bank Street.
James Greig, W.S., 32 Hanover Street.
Thomas Handayside, Fisherrow.
Eagle Henderson, 81 George Street.
Charles Lawson, 1 George IV. Bridge.
Dr. J. T. Mackay, College Botanic Garden, Dublin.
Stewart Murray, Glasgow Botanic Garden.
Charles M'Intosh, Dalkeith Palace.
Edward Sang, senior, Kirkcaldy.
John Smith, Royal Gardens, Kew.
Alexander Wright, 1 Greenside Place.

William Brand, W.S., 5 Northumberland Street, *Treasurer.*
William W. Evans, Experimental Garden, *Secretary.*

training, and have no reason to doubt but that he is well qualified for the duty of Keeper of Montreal Park. I should add that the late Mr. McNab's position and character were of the highest and in themselves no trifling warrants of the probable abilities of his sons. (Sgd.) JOSEPH D. HOOKER, Director.

—*By permission of Miss McNab from the original letter in the possession of Mr. William McNab, Montreal.*

The circular is undated, but as Dr. Neill was one of the Interim Committee the issue must have been before 1851, in which year Dr. Neill died. Nothing came of the movement. I have the impression that the Committee failed to obtain the consent of the Crown to the placing of a monument in the Garden.

APPENDIX A.

HINTS | ON THE | PLANTING AND GENERAL TREATMENT | OF | HARDY EVERGREENS | IN | THE CLIMATE OF SCOTLAND, | Particularly the following:— | Strawberry Tree (Arbutus Unedo), | Common Holly (Ilex Aquifolium), | Common Laurel (Prunus Laurocerasus), | Portugal Laurel (Prunus lusitanica), | Alaternus (Rhamnus Alaternus), | Laurestine (Viburnum Tinus):— | By WILLIAM McNAB, | Superintendent of the Royal Botanic Garden of Edinburgh; | Associate of the Linnean and Medico-Botanical Societies of London; | Corresponding Member of the Horticultural Societies of | London and Edinburgh, &c. | EDINBURGH: | THOMAS CLARK, 38 GEORGE STREET. | MDCCCXXX.

The plants enumerated in the title of this paper are only a few of the hardy evergreens that are cultivated in Scotland; but I am convinced, from long experience, that any person who successfully plants and cultivates them may cultivate almost any other hardy evergreen with equal success.[1]

It is unquestionably true that evergreens are cultivated in Scotland much more sparingly than good taste would dictate. Everyone capable of enjoying the beauties of rural scenery must regret this, and in proportion to such regret will be his desire to see the evil corrected, which is the sole object of the present essay. But, in order to correct this evil, it is necessary, in the first place, to refute certain prevailing errors which, as I apprehend, constitute its cause. I am persuaded it cannot generally be attributed to unconsciousness of the defect and consequent carelessness about having it remedied; for I have seen, with regret, many instances where failure attended anxious endeavours to cultivate evergreens on a very respectable scale.

There are other reasons than those of good taste alone which would lead to the cultivation of evergreens in large quantity, were the certainty of their successful cultivation, which I am now to demonstrate, better understood. They furnish admirable shelter for game of every description, and there are few followers of the hounds who would not willingly draw a laurel alternately with a gorse cover. Even the value of some evergreens, as a crop, is enough to secure for them attention; and, if there be any landed proprietor who can look with indifference at the beauty of a

[1] I wish it to be understood that, in speaking generally of evergreens, I do not include the Fir tribe.

plantation interspersed with underwood of well-selected evergreens, he may, notwithstanding, kindle with eagerness at the contemplation of the price which would be paid for some sorts on account of their value in various arts. It is not, therefore, because there is no motive for their cultivation that evergreens are neglected in Scotland, nor because those motives are unappreciated. Is it because our soil or climate is not adapted to their constitutions? This is a very common error, but that it is an error will be very easily shown. I will venture to assert that there is not in a more thriving state in any district of Britain a collection of evergreens of such variety and extent as that in the Royal Botanic Garden of Edinburgh, nor one which has made a better appearance in so short a time after planting.

Every person in Scotland who takes the least interest in such questions must recollect having seen in many districts splendid examples of evergreens which would do credit to any soil or climate; and very rarely indeed do any of the species named in the title of this paper suffer materially from our severest winters. No doubt I have seen the common laurel cut down to the ground in some parts of Scotland from the intensity of the frost, and the Portugal laurel and laurestine have been known to meet the same fate; but this very rarely happens, and perhaps never, except in inland parts of the country and in situations which are low and damp. I apprehend the principal cause of the scanty culture of evergreens in Scotland may be found in circumstances more discreditable to the Scotch cultivator than an indifferent soil or climate, but which are fortunately more susceptible of remedy; and I am not without hopes that a due consideration of the cause may tend, in a great degree, to put the matter on a right footing.

I have had considerable experience in the planting of hardy evergreens of all sorts and various sizes, indeed perhaps greater experience than generally falls to the lot of practical gardeners. This experience has been gained under the eye of the public, and I believe I have obtained a degree of credit for success equal to any of my brethren in the profession; at least, I am not aware that I have been censured for want of success in what I have attempted; and, as times go, if a man in a public situation, acting under the public eye, escapes censure, it may, I presume, be fairly inferred that he does not deserve censure. As I am quite persuaded that the chief cause of failure in the cultivation of these most ornamental plants proceeds from the uncontradicted promulgation of certain instructions regarding the season and manner of planting, which are, indeed, reiterated by almost every author who treats on the subject, and the too ready compliance with these instructions, I am not without hope that a few hints derived from the practice I have had may be useful to the gardener whose only experience has been in acting under such instructions. Should I be fortunate enough to express intelligibly my ideas upon this subject, and intelligibly to detail my practice, and if that practice shall be followed, I doubt not we may soon see evergreens in far greater abundance than heretofore in the pleasure-grounds of noblemen and gentlemen, and

even as underwood in extensive forests; for I cannot permit myself to imagine that it is either the want of taste or of climate, neither is it the unsuitableness of soil, which has prevented their abundance hitherto.

I do not, however, mean to insinuate that the injudicious management of the gardener is the sole cause of evergreens being found in much smaller numbers and in much less perfection than could be wished. On the contrary, I wish it to be understood that I believe many gardeners know as well as I do how to plant, and how to treat these essentials in a fine landscape; various causes interfere to put it out of the power of the gardener to plant at the proper season, or to bestow that attention which they absolutely require to establish their health.

I am anxious, however, to show that without a certain degree of attention and a proper selection of season it is only a waste of time and of money to make the attempt, in order that, where circumstances can admit of it, attention may be given to details, which I know will ensure success.

Much has been said of late about the ignorance of Scotch gardeners, particularly in a work written by Sir Henry Steuart, entitled, "The Planter's Guide," to which someone has written an answer in a pamphlet under the title of "Strictures on Sir Henry Steuart's Planter's Guide, by a Planter of some Experience."

I think this defence of the profession by the author of "Strictures" was unnecessary. Sir Henry is very unmeasured in his censure, but a libel is innocent when it is notoriously overcharged.

I am somewhat interested in this controversy, in so far as Sir Henry has taken from me all the credit of our success in transplanting the trees from the old Botanic Garden and transferred it to Dr. Graham. But this excites in me no degree of anger, because Sir Henry at the same time attributes this success chiefly to the circumstance of Dr. Graham having, at his (Sir Henry's) suggestion, adopted the *previously unheard-of expedient* of cutting the roots round the plants sometime before transplanting, though before "The Planter's Guide" was written I most distinctly recollect hearing Dr. Graham say that he told Sir Henry that neither he (Dr. Graham) nor I claimed any merit for inventing what every schoolboy knew, and that in point of fact I had prepared the roots of a number of the transplanted trees in the spring of 1819, before Dr. Rutherford's death, and, consequently, before the present Professor of Botany had anything to say in the matter.

These statements Dr. Graham has made so often, both in his lectures and in private conversation, that I am sure they are generally known; and, therefore, an assertion that I was ignorant of this fact, till I got my information, at second-hand, from Sir Henry, gives no sort of uneasiness.

With regard to the charge of ignorance brought by Sir Henry against practical gardeners, much will depend upon his definition of this word. If by ignorance is meant a want of scientific knowledge, of which Sir Henry makes no little parade, I must at once admit the justice of it. But if he interprets it into a general want

of practical knowledge of our varied profession, that is a point I am not disposed so readily to concede; for, even with regard to Arboriculture, a branch which Sir Henry seems to think he has made peculiarly his own, I am not prepared to yield the palm to him, and there are, I am convinced, many other practical men who are more than his equal in a knowledge of that branch of the art. But leaving the decision of this matter to competent and disinterested judges, there are many things in regard to which Sir Henry's science might have been better employed than in scattering calumnies against a class of men who, until he chose to stigmatise them, possessed, and, notwithstanding the *fearful weight* of Sir Henry's *testimony* against them, I will dare to say, still possess, a tolerable reputation all over the three kingdoms. With all my admitted ignorance of science, I flatter myself I have not been altogether an inattentive observer of the operations of nature, some of which, when I could discover their *rationale* have been useful to me. But there are not a few, the causes of which are to me wholly unknown, which, if rightly explained (and a proper application of science might, perhaps, effect this), would afford much gratification to the inquiring minds of ignorant gardeners, and might be of great practical use. I shall here notice some of these, regarding which I can answer for myself, and I think I may say also for my brethren in the profession, we would rejoice, and with gratitude, over any information which Sir Henry's science may afford us.

In walking through the Botanic Garden (not having been at Allanton, I can only guess that such things may also be seen there), I occasionally come to two evergreens of the same species, of equal age, planted out within the same hour, treated precisely in the same manner, growing in the same soil, and which, in fact, had never been ten feet removed from each other, since, as cuttings, they were severed from the same bush, and I observe that one of them is nearly twice the size of the other, and yet both appear equally healthy. Now, how this happens, I admit myself to be profoundly ignorant.

I also frequently observe in the Botanic Garden two neighbouring evergreens of the same species, which have arrived at the same age, under similar circumstances; in the one, every leaf is entire, green, and healthy; while the half of every leaf of the other is brown, withered, broken, and dead—why, I do not know.

In the same walk of the garden I have seen two evergreens, both exotic and natives of a warmer climate than ours, from the same field, in the same country, treated precisely in the same way in this, the one enduring with impunity sharp frost, the other losing nearly all its leaves, and the tips, at least, of its branches, whenever the thermometer falls a few degrees below the freezing point. The cause of this peculiarity of constitution is another instance of my admitted ignorance.

Farther, after a sharp frost of some duration, I find another enigma in the operations of nature within the same ground, which makes me feel, and I here readily acknowledge, my ignorance. Two exotic evergreens, of different species, close beside each other, and

similarly exposed, have suffered very differently; in the one, all the young wood is killed, but the old wood of the stem and branches is perfectly sound, and quite in a condition to push out abundance of healthy shoots in spring. In the other, the bark on the old wood, everywhere above the surface of the ground, is torn, peeled, and dry, and the plant, therefore, irrecoverably dead, yet the young wood at the tips of the branches, and even the leaves covering them, though totally unprotected, are all alive, have sustained not the slightest injury, and, if taken off, will form healthy thriving cuttings. I cannot even form a tolerable conjecture as to the cause of this difference of effect on plants, which, though of different species, are, to all appearance, both in habit and structure, extremely similar.

Another thing I observed in the Botanic Garden, in the beginning of April, 1828, which I find most difficult to explain. Early in February of the same year, some evergreens having been taken from a thickly shaded plantation, immediately upon the north side of a high wall, where certainly they could not have seen the sun for several months, and where they grew in rather damp soil, were planted in an exposed situation, and in very sandy soil, by the side of similar species, which had not been moved for several years. Both looked perfectly healthy; but in March a severe drying frosty wind set in, and, I think, every one would have expected that the plants which had been lately moved would have suffered most, yet they escaped without a leaf being injured, though, from the situation in which they previously grew, they must of necessity have been destitute of all "prerequisites and protecting properties"; but their neighbours, which had occupied their ground for years, were all more or less injured, having their leaves, or great part of them, destroyed, and the points of many of their youngest shoots killed.

My next puzzle I must state upon the authority of another—I certainly know no parallel instance myself. In the *Gardener's Magazine*, Vol. V, p. 669, we are told that on the west coast of Scotland (the particular place is not named) the *Digitalis canariensis* "is one of the hardiest plants we have, and ripens its seeds abundantly, retaining its verdure throughout the severest winter, and is, indeed, quite an evergreen shrub."

Now, supposing the fact to be so (for, be it recollected, I by no means state it on my own authority), I think it most extraordinary; for I know well that, on the east coast of Scotland, a degree of frost, much less than occurs in any part of the west of Scotland which I have been in, is sufficient totally to kill the *Digitalis canariensis*; and it is utterly incomprehensible to me how, on the west coast, this plant has acquired a power of resisting cold which I know it does not possess here.

These, and a multitude of other examples of admitted ignorance, might be quoted against Scotch gardeners, and we must be content to bear the imputation, suspecting all the while, however, that we are not very singular. These, and a thousand similar instances, it does seem to me, form the difficulties with which it is the province of "science" to grapple; and he who shall solve them may, in

justice, without egotism, without the risk of being laughed at for arrogating to himself and to his subject more importance than they deserve, and, certainly, without running the risk of a charge of plagiarism, claim for himself all the merit of an original discoverer.

Without, however, such lofty pretensions, we may all be useful. The art of the gardener and forester is an important, and it is a multifarious one. We cannot each of us do everything; some of us have a reputation for succeeding in one department, others are most successful in another, and some of us could at one time do what we afterwards very generally fail in, and are compelled to admit that *we hae tint the gate o't.*

> "One science only will one genius fit;
> So vast is art, so narrow human wit,
> Not only bounded to peculiar arts,
> But oft in those confined to single parts."

I have sometimes heard men say they were equally expert at everything; but it is not an unfair rule which places these actors of all work at least as low as their neighbours. When we confine ourselves, however, to the particular departments in which we have had unusual experience, we may very often do good in our generation by making known the little improvements which our own blunders and the observations of those of others during their operations have suggested. Upon this principle, then, Sir Henry Steuart's "Planter's Guide" has really been a boon to the public; and upon the same principle, perhaps, these much more humble "Hints on Planting Evergreens" may be of useful application. Much credit is undoubtedly due to Sir Henry; for it does appear from his book that, at great expense, and by the accumulating experience of years, he has at length acquired the power, though in very unpropitious circumstances, of applying, with much greater success than they did, the directions of our grandfathers for transplanting trees; and I think it is equally certain, their operations have in the detail been, in some circumstances, improved.

But it is now time, perhaps more than time, that I should turn to the proper object of this paper.

The seasons already recommended by different authors for planting evergreens are very various. In general, however, we find that the popular directions is to plant early in autumn or late in spring, that is, in August and September, or in the end of March, in April, or early in May.

Miller, in speaking of the common laurel and Portugal laurel, says, "When a large plantation of laurels is intended, the work of transplanting may be done at any time during winter, when the weather will permit, but October is the best season."—*Martin's Edition of Miller's Dictionary.*

The same author says that the "best season for transplanting *Arbutus* is September"; "*holly*, in autumn, in dry land, but in cold wet soil they may be transplanted with great safety in spring"; "*laurestine*, Michaelmas is the best time; they may also be

removed in spring with balls of earth, or in the end of July or beginning of August, if rain should happen at that season;" "*Alaternus*, they may be transplanted either in the autumn or the spring, but in dry land the autumn planting is the best, whereas in moist ground the spring is to be preferred."

The same author says, in his article on Planting—"The seasons for planting are various, according to the different sorts of trees, or the soil in which they are planted; for such sorts as the leaves fall off in winter, the best time is the middle or end of October, provided the soil be dry, but for a very wet soil it is better to defer it till the latter end of February, or beginning of March; and for many kinds of evergreens, the beginning of April is by far the best season, though some sorts may be safely removed at midsummer, provided they are not to be carried very far; but you should always make choice of a cloudy season, if possible at that time of the year, when they will take fresh root in a few days, and, on the contrary, when these trees are removed in winter, during which time they are almost in a state of rest, they do not take root until spring advances and sets the sap in motion, so that many times they die, especially if the winter proves severe."

Thus Miller leaves us a little in the dark, after all, as to the best season for planting evergreens in general: he says, as above, that when a large plantation of laurels is to be made, they may be planted any time during winter, when the weather will permit, but October is the best time; but in every other passage he says spring, autumn, or summer; and in his article on general planting, he says April is the best time, and endeavours to show that winter is a bad time for doing such work.

Loudon, in his *Encyclopædia of Gardening*, on the culture of nursery trees, page 979, says,—"All the deciduous sorts may be transplanted in February, or early in March; and all the evergreens from the middle of April to the middle of May, and during the month of August."

The same author, in his *Kalendarial Index*, in the above work, recommends the end of March, April, or early in May, and last week in August, for planting evergreens; and for the month of April, in the same index, we have the following directions given:—"Plant evergreen trees, as pine, fir, cedar of Lebanon, holly, and yew, during the month, but finish planting deciduous sorts as early as possible." "Wherever the plants are to be, or have been, long out of the ground, take good care to dry up their roots by exposing them as much as you can to the sun and air; do not be nice in planting."

I cannot but think that these recommendations have, through inadvertency, been printed, because they are quite at variance with judicious instructions given elsewhere by the same author; and, as far as I am able to judge by my own experience, or from the dictates of obvious analogy, are opposed to everything like successful practice.

We are told, in Sir Henry Steuart's *Planter's Guide*, 1st edit., p. 440, that "by planting early, that is, soon after autumn, or not later

than February and March, all trees (oaks and evergreens excepted) are surprisingly benefited." Now, this experienced planter has told us the time that is improper to plant evergreens; but I am not aware that he has anywhere expressly told when the proper time is for performing such work, though I think he has left us to infer it. He gives us an instance, p. 319, of having planted some hollies in March, and some of them having died. It is fair, therefore, to conclude that March is an improper time. Indeed he says so; and if winter, February and March is a bad time. If we exclude summer, which probably he would, there is only the autumn and April and May left when such work can be done; so that we may suppose, that had he recommended any particular time, it must have been either autumn or spring, the favourite time for planting evergreens with almost everybody except myself. Now, besides the foregoing authorities, many could be quoted, all recommending nearly the same season for planting evergreens.

If we ask nurserymen what is the best season of the year to plant hardy evergreens, the answer of five out of six will be spring or autumn, or perhaps early in autumn, or late in spring. If we ask practical gardeners the same question, the same answer will be received. If we go a little farther, and ask a nurseryman to take the trouble of looking over his books to ascertain what months in the year he executes the greatest number of orders for evergreens (no matter whether the orders are directed by the gentleman or the gardener, to be forwarded at a particular time, or whether, as is frequently done, the time is left to the judgment and discretion of the nurserymen), we shall find that the greatest number of orders for evergreens stand in their books for April and May (in some twice as many as for any other time), and next to that in August and September, and very few are sent out at any other time, all showing that the general feeling is that spring and autumn are the best seasons for planting evergreens.

But there is another kind of evidence on this subject, which I value more, but which I have often in vain attempted to obtain—the evidence of experience rather than of theory. I have often asked gardeners, if they have happened to plant evergreens in August or September, in November or December, in April or May, which of his plants he found to thrive best, which to succeed worst; but I rarely can get a better answer than, "I would consider those planted in autumn as more likely to succeed best"; or, "I would expect that those planted in spring would do best"; but most express their belief that those planted in winter would do the worst.

This, however, is not at all satisfactory to me. I want facts, but find it extremely difficult to obtain them from others. I want to know from gardeners, who may have planted evergreens repeatedly in these three seasons with equal care; I want to know, from their own observations, and at the end of a year or two after planting, which of these evergreens have succeeded best, and which have done worst, but never got one to answer satisfactorily.

This, I hope, I shall be able to answer satisfactorily from my own experience before I have done with this subject. I know it will be

considered a bold step in me (I tremble when I think of it), in the face of all the authorities already quoted, and in opposition to the opinion of a great proportion of the practical horticulturists in the country, to come forward and assert that the seasons usually recommended for planting evergreens, viz., spring or autumn, are far from being the best —are, in fact, under most circumstances, the very worst season which can be selected for performing such work. I know that many will exclaim, as soon as they see this, that I am wrong; the reader is quite entitled to think so unless I shall show, as distinctly on paper as I can in practice, that I am right.

First, then, if I shall be able to show that winter is no worse a season for planting evergreens than the seasons already recommended, I shall certainly have gained a considerable point. To render this not improbable, I may recall the attention of the reader to the fact, that the seasons recommended by the different writers quoted are various, and that, therefore, the point has not been looked upon as settled, and, if still doubtful, the decision may ultimately be in my favour. It farther appears that winter planting has, in certain circumstances, been permitted by authors, but not recommended. It also appears from the above quotations that the season recommended varies with the kind of evergreens to be planted. Now, if I am right in asserting, and my experience has taught me to be confident that I am, that the evergreens I have mentioned, as well as all other hardy evergreens that I am acquainted with and have had experience in, may be planted at the same time, and even in the same day, with equal success, another material point is gained; for when large plantations of evergreens are to be made, it will be found much more convenient to get them all from the nursery at the same time, and to plant them all at the same time, rather than to get one kind in spring, another in August, another in September, another in October, and so on.

I may mention that I have planted evergreens at all seasons of the year with nearly equal success, except from the middle of June to the middle of August, and even during this period I have planted some; but unless the weather is very dull and moist, and even with such weather it is difficult to prevent the plants suffering considerably, and in many cases it is years before they recover; although, however, I have planted evergreens ten months out of the twelve with little difference in the success, yet one season has a preference over the others with me, and when there is the power of choice, I would recommend late in autumn, winter, or very early in spring; that is, any time from the middle of October till the middle of February, and in general the beginning of this period is the best; that is, from the middle of October till the middle of December, always providing that the weather and the ground are favourable; that is, supposing there is no frost, no drying wind, nor much sunshine, and that the ground is not too much saturated with wet, either from continued rain or from the nature of the soil. One of the principal things to be attended to in planting evergreens, is to fix on a dull day for winter planting, and moist day for spring and autumn planting. There can be no secret in the proper treatment

of evergreens; if there were, I should say that it is in preventing their roots from becoming dry when out of the earth; to choose moist and cloudy weather for planting; and, still better, if we had the power, by foresight or otherwise, to secure a continuance of such weather some time after they have been planted. If the roots of evergreens be allowed to dry when out of the ground in spring, it is scarcely possible to prevent their suffering considerably and showing this injury for a long period after they are planted. Now, it is quite true that we occasionally have such weather as I have said is fit for our purpose in spring, and too often even in summer, and therefore it has happened, as I have already said, that I have planted successfully during ten months of the twelve. But though we seldom can have difficulty at any season in selecting a moist day, or at least some hours in which the weather is sufficiently moist for planting, yet I know no secret by which, at any season, we can determine that, after planting, we shall for a week or more be free from sunshine; and I know, in common with everybody who has any experience in planting evergreens, that they suffer considerably if exposed to a hot sun immediately after being planted. Though I know no means by which I can divine what the weather may be some days after planting, yet we all know that in winter there is a greater probability of moist cloudy weather than at any other season; and we also all know that, even if we should be disappointed, and the weather become clear after planting, yet the sun is but a short while above the horizon in winter and has but little influence. Half a day's sun in spring or autumn will do more harm immediately after planting than a whole week's sun from morning to night in the middle of winter. If, therefore, there is no other objection to planting in winter, it is on this account the best season, for we are often days, and even weeks, without sunshine, and I have seen no instance of evergreens planted in the middle of winter, and properly treated, thriving worse than others planted in August, September, April, or May, even when these got a few days or a week of dull moist weather after planting. If, then, we are certain, which I am, that evergreens planted in winter will thrive as well as those planted in spring or autumn, under the most favourable circumstances, and if we find, as I do, that evergreens planted in winter will do much better than those planted in spring or autumn, under unfavourable circumstances, then, surely, the winter planting must be the best; for we find, at that time, that we can always plant (except during severe frosts, or in a very drying wind) with perfect certainty of success, whereas, in spring or autumn, there is great risk of failure, except we can get a few dull days or moist days after planting, and this is quite uncertain.

Now, I think I have shown that we can plant evergreens during winter with greater certainty of success than at any other time; and I am equally convinced that we can plant them with less trouble, and, consequently, at less expense, than at any other season; for, when evergreens are planted in the winter, and treated as I shall recommend, as being found to be the best, they cannot require so much water when planted; indeed, the ground

will seldom take in so much as it will do in spring or autumn. When planted in winter they will scarcely ever require any watering during the following summer, unless it should prove very dry, and unless the plants are of a pretty large size. On the contrary, if planted late in spring, they will, in general, require once watering during the summer to ensure the same success as in those planted in winter; the same holds good with those planted in August or September, as we often find the ground as dry then as at any other time of the year, so that by winter planting we ensure the same success and save labour in watering. The advantages of winter planting are so great and manifest that it seems strange they should have been overlooked. I am persuaded that it is false theory that has excited all the prejudice that exists on the subject. We are told that evergreens planted in winter can push out no roots till spring set their juices in motion, and that, therefore, while in this state of inaction, they run great risk of being killed. Now, I must take the liberty of disputing the assertion upon which this inference is founded. Winter transplanted evergreens do make roots before spring, and therefore cannot, on account of the want of them, be more easily killed. I do not mean to say that in a continued frost which lasts for months, and where the whole earth about the root is congealed into a mass, the roots of evergreens will grow; but we never have such continuance of severe frost in this country. During the winter we often have intervals of a week or a fortnight, and even sometimes three weeks, of mild weather, and in such weather the roots of many evergreens do grow. Let any person that has a few duplicates of different kinds of evergreens to spare, plant or lay them in by the heels, and soak them well with water, any time during the period I have recommended as the best for planting; let him take these same plants up again in the end of March, April, or beginning of May following, he will find they will have made a considerable number of fresh roots between the time he put them in and the time he took them up. Every nurseryman knows, that of the cuttings of some sorts of evergreens put into the ground, as is usual, in September or October, many will have made roots during the winter, as will easily be seen by taking some of them up in March, April, or May.

Since, then, we find that the roots of some plants grow in winter, why not give the plants the benefit of these roots by planting them at such a time as will afford that opportunity before the hot weather of summer comes on? For, by having such roots, they will be better able to resist injury than if they had to make them after April and May.

I do not mean to say that all the evergreens that have been planted in the Royal Botanic Garden within these few years have been planted in the winter. I have already mentioned that I have planted them at all times, as it often happened that I had not a choice of season; a considerable number of them, however, has been planted in the winter, both in the dry part of the garden and in the wet part, and all have done equally well.

One thing, which I may mention, operates very powerfully against planting evergreens in winter. No gardener, unless he has had very extensive practice in planting evergreens at all times, and knows from his own experience that they may be planted with perfect safety in winter as well as in spring or autumn, is safe to plant evergreens, except at the times generally practised and generally recommended; for if, from careless planting or other causes, part of these evergreens that he has ventured to plant in winter does not succeed, he will be blamed for the failure, as having planted them at an improper season; nay, he will perhaps blame himself for so doing. Even his own men, amongst themselves, will say, "O, no wonder master did not succeed with these evergreens, when he has chosen to plant them at a time when nobody else but himself would have thought of doing such work."

If the same gardener had planted the same number of evergreens at the times usually practised and recommended for such work, and had the same number of failures as in his winter planting, no notice probably would have been taken of the circumstance, seeing the work had been done at what is considered the proper time.

The very same thing holds good with nurserymen; for, supposing they get an order for evergreens, to be executed at the time they would recommend as the best, if they execute this order in winter, and a quantity of the plants do not succeed, they will be blamed for sending them at an improper season. There cannot be a doubt but this is what operates with nurserymen, and prevents them from sending out such orders in winter; for it is evident that it would be more advantageous to them to have their orders made up in winter, as they would be thus enabled to get their ground cleared and ready for planting; whereas, by the present practice, their own evergreens are almost always too late of being planted in spring, partly from the ground not being cleared, and from it being uncertain how many evergreens may yet be required to fill up orders.

I have no title to originality in planting evergreens in winter, nor any wish to claim it. Many examples might easily be found of evergreens having been successfully planted in winter—planted, perhaps, before I knew what an evergreen was; and it is only astonishing that some one did not come forward earlier and make this more generally known. It is needless to wander through the country to seek such examples; I already know where to find some, and I am satisfied I could find many more.

I shall take one example, which may be seen without much trouble by any one interested about evergreens, and who is in, or who may happen to visit, modern Athens in winter. I say winter; because then, I think, evergreens are seen to more advantage than at any other season. Let any one look at the evergreens in Hillside Crescent, by the side of the new London Road from Edinburgh, in front of the house of the Right Honourable William Allan, Esq., of Glen, present Lord Provost of the City of Edinburgh. They are principally Portugal laurel, common laurel, laurestine, holly, Alaternus,

and a few specimens of Arbutus, and were all planted in the months of November and December, in the year 1824, and under his Lordship's own immediate auspices, and without any other watering, even at the time of planting, but that which fell upon them from the heavens. Of many hundreds, nay, I believe, several thousands, of those evergreens planted in that Crescent at the above time, very few failures occurred; but an instance of evergreens planted in the spring of the following year will be given hereafter (p. 342), which proved nearly a total failure. Now, let any person compare the evergreens in Hillside Crescent with all the evergreens in the public squares, crescents, circuses, places, or gardens in Edinburgh, and if they are not satisfied that the winter is a good time for planting evergreens, they must at least, I think, be satisfied that it is not the very worst time that can be fixed upon. This qualified acquiescence in my opinion, is, perhaps, all that I am entitled to hope for; for, notwithstanding all that I have said about planting evergreens, and notwithstanding my belief that all which I have said is founded on common sense, and has even proved to be correct by long and extensive practice, yet many a person, from prejudice, obstinacy, or indolence of mind, will argue, what everybody says must be right; and as almost everybody says, that spring and autumn is the best time for planting evergreens, it is not likely that anything I have said, or can say, will be the means of inducing people in general to change to the time that I am satisfied, from practice, is the best for performing such work. "Errors of long standing can only experience a lingering death."

The treatment, however, which I shall recommend is nearly the same at all seasons; only in winter they may be planted with perfect safety in a dull calm day, whereas in spring or autumn a moist rainy day is preferable to any other; but where a person has not a choice of such weather, then the work should be performed in the evenings after the sun gets low, particularly in spring or autumn planting.

The way, however, in which I have treated evergreens is not so easy in all its detail, where a great extent of ground is to be gone over, but I think in three cases out of four it may easily be adopted; indeed, it may be easily done in all cases, for it is only planting ten instead of twenty, and it requires no great depth of knowledge to see that ten plants which thrive well, is better than twenty plants, ten of whom will die, and perhaps five more remain sickly for years. From what I have seen, this is by no means an unfair calculation, particularly when large-sized evergreens are got out of a nursery (but of this I shall speak afterwards), sent to a distance, planted at the usual season, and treated in the ordinary way.

Some years ago, after we had made some progress in lifting pretty large plants, both evergreens and deciduous, and transporting them from the Old Botanic Garden to the New, an amateur chose to bestow some pains upon me to teach me how to move such. He was very minute in stating the exact process he adopted, and urged me to adopt the same plan. About fifteen years before that he said he had planted twenty pretty large plants, or rather small trees

(which, I suppose, was the full extent of his practice in the art); he also told me the exact sum of money each cost in removing and planting, which I considered very moderate; but, unfortunately, he closed his narrative by saying that he did not know from what cause—he supposed the plants had not been properly taken care of after removal—but every one of these twenty died the same year they were planted, and he added, "I suppose you expect a great many deaths among yours also." Now, it will surely be better to plant only one that will thrive and do well, than twenty which will die; therefore, nothing can be more evidently proper than the rule, "Do the work well, and do the less of it."

I have already mentioned, that in planting evergreens in winter, a dull calm day answers very well, but in autumn or spring a moist rainy day is the best. I have at times been as wet planting evergreens as I have been when exposed for hours on the windy side of *Ben Nevis* in a wet day, without great-coat, and a broken umbrella.

In planting evergreens, whether in a dull day, a wet day, or a dry day, it is very necessary to keep in view the expediency of keeping the plants for as short a time out of the ground as possible; if only a few minutes, so much the better; and in all cases when it can be done, where great numbers are to be planted, we should, if possible, have some men stationed to take up the plants, others to carry them, and a third set to put them into the ground. In all seasons, situations, and soils, the plants should be well soaked with water as soon as the earth is put about the roots.* Where the water is not at hand, so that it may be easily carried or wheeled by men, a horse with a water-barrel on wheels should be used, as I am certain this will be amply repaid by the success of the plantation afterwards. As soon as the plant has been put into its place, the earth should be filled in, leaving a sufficient hollow round the stem, and as far out as the roots extend, to hold water, which should then be poured in, in sufficient quantity to soak the ground down to the lowest part of the roots; in short, the whole should be made like a kind of puddle. By this practice, which is particularly necessary in spring and autumn planting, the earth is carried down by the water and every crevice among the roots is filled. Care must always be taken to have as much earth above the roots of the plants as will prevent them from being exposed when the water has subsided. I find the best plan is to take an old birch broom, or anything similar, and laying it down near to the root, I cause the water to be poured upon it; this breaks the fall of the water, and prevents the roots from being washed bare of such earth as may adhere to them; in this way time is saved, for the water may be poured out in a full stream from a pail, a water-pot, or even from a spout or pipe in the water-

*This is universally true, but the urgency is less where the evergreens are planted in winter to form underwood in extensive plantations. In this case the deaths without watering will be so few that they are not worth avoiding at much expense and trouble.

cart or barrel, where the situation is such that this can be brought up to the plant. After the first watering has dried up, the earth should be levelled round the stem of the plant, and as far out as the water has been put on, but not trod; if the plants are large, a second watering is sometimes necessary, but in ordinary sized plants one watering is quite sufficient, and after remaining twenty-four hours, more or less, according to the nature of the soil, the earth about the stem, and over the roots, should be trod as firm as possible, and after treading, should be dressed with a rake. Where this is practised, and the planting done at the time that I have recommended, there is scarcely a chance of any dry weather afterwards injuring them; but if this method, or something similar, is not practised, there will be a great risk of failure every year, in planting evergreens, particularly when they are planted at the usual times recommended, that is, in spring or autumn. I wish it to be distinctly understood, and I speak from practice, that I should always water evergreens when planted, whether the work is done in wet weather, dull weather, or dry, or whether the situation in which they are planted is wet or dry, sheltered or exposed, because the watering, as I have recommended, fills up the holes that may be in the earth about the roots and consolidates the whole mass much better than treading could do. It is therefore necessary at every season, but much less will be required after winter than spring or autumn planting. Within these few years I have planted an immense number of hardy evergreens, of all sorts and various sizes, both in wet ground and in dry ground, in autumn, winter, and spring, and they have been all treated in the way I have recommended.

In transplanting evergreens, it is desirable to leave as much earth about the roots as possible, but when treated in the way I have recommended, I consider the greater part of the earth that may be about the roots of importance, in preserving them from injury during the operation, rather than for any value it may have after the plant has been put into the ground. I am, however, speaking of ordinary sized plants, that is, from one to two and a half or three feet high; if much larger than this, I never could move them with success, without keeping a large ball of earth about their roots, and keeping it as entire as possible. One hint more, and then I have done with this part of the planting of evergreens. It will be found a useful appendage to the foregoing, without which, all that I have said will sometimes be useless, and the want of attention to which I have, at times, seen produce much mischief; it may prove especially useful to those who have much of such work to perform. It is, that I very seldom trust the planting of evergreens to workmen without being present to superintend the work. Every gardener, however, cannot do this, but when he cannot, he should give the charge to a very trusty man in his absence.

I am aware that when evergreens have to be got from a nursery and sent to a distance, where they must often be days, and even weeks, out of the ground, that the method I have recommended cannot be adhered to. In this case, nurserymen ought to be very

careful to injure the roots as little as possible in raising them, and to have them out of the ground as short a time as possible, and when packed, it should be in such a way as to prevent the roots from becoming dry, even if they were in the package for a fortnight. They should always be packed in hampers, with strong rods or stakes round the tops, and covered with a mat, and the tops of the plants should be left as loose in the inside as possible, never tied close together much above the level of the basket edge, as they sometimes are. When tied close together at the top, if they are long in the package, there is a great risk of many of them losing their leaves soon after they are unpacked, and with the best management, it will be long before the plants recover. Care should also be taken never to allow the roots to dry between the time they are taken out of the ground and the time they are packed. This method of packing would, no doubt, add a little to the weight, and, consequently, to the expense of carriage. The safety of the plants, however, will be found far to overbalance this additional expense of carriage. The careful way, too, in which they should be packed, would entitle the nurseryman to make a higher charge for his package; but this additional charge, too, would be amply repaid to the receiver by the superior state his plants would be in.

I am aware, however, that to attend to all this when evergreens are got out of a nursery in spring is very difficult. Let any man look into a nursery in April and May, the time that we have found that the greatest quantity of evergreens are sent out, and see a large order of evergreens of different kinds taken up from different parts of the nursery, see them all collected together and packed, he will find that at that season, in a dry day, under the most careful management, it is scarcely possible to get all this done before the roots have become perfectly dry. We know that evergreens are never taken up in a wet state to be sent to a distance, or, if they are taken up wet, they must be exposed till the leaves get dry before they are packed, which is nearly as bad as taking them up when dry. Now, these plants could, with perfect ease, be all taken up, collected together, and packed in a dull day in winter, even with ordinary care, without having their roots dried up; and I cannot too often repeat that this is always a primary consideration in transplanting evergreens. If, therefore, people will not plant evergreens in winter, I would, at all events, recommend them to get these plants out of the nursery in winter, to lay them in by the heels, soaking them well with water, and to let them lie there till what they call the best time for planting arrives; and then they will have their plants in a far better state than when got out of the nursery in April or May. I cannot help here taking notice of a quotation in the *Planter's Guide*, first edition, page 356, said to be obtained from one of the most candid and intelligent nurserymen in Scotland, for, although it alludes principally to forest trees, it applies equally well to evergreens.

This candid nurseryman is made to say—"Give gentlemen who are the most partial to planting but cheap plants, and they neither know nor care about the quality." (He is again made to say) "His

study, therefore, never is, nor can be, science, or the quality of his plants, but solely and exclusively the art of raising the greatest possible number on the smallest space of ground, and furnishing them to his customers at the lowest possible price."

Now, if this is the feeling among gentlemen and nurserymen (which I hope it is not), we cannot expect much attention, on the nurseryman's part, to the growing, taking up, and packing evergreens, in the best possible way, so as to ensure success with them when they arrive at their ultimate destination. He must receive a price for his article and for his packing which will enable him to live by his profession. This is, however, wandering out of my tract, and, perhaps, treading on rather brittle ground. I may mention, that in whatever way the plants are packed, or in whatever state they arrive, they should be unpacked immediately and laid into the ground, their roots covered over with earth (if possible, in rather a shady situation), and well soaked with water, until a favourable time arrive for planting them out. It will, however, in all cases where the plants have suffered in the package, be better to plant them out in a piece of nursery-ground, pretty close together for the first year, and plant them out the second year where they are intended to grow, always taking care to water freely. There are several kinds of evergreens which should never be ordered from the nursery unless they have been reared in pots; for among these, even with the most careful management in taking up, packing, and other after treatment, it is scarcely possible to prevent a number of failures. Even the *Arbutus* and *Alaternus* are among that number, unless they have been fresh planted in the nursery every year. The circumstance, however, of these plants having been kept in pots, implies that a nurseryman must have a higher price for them than for plants grown in the open ground without pots; but the superior state of the plants, and the success with them afterwards, would more than make up all the difference of price. I shall add a list, at the end, of those sorts that should always be kept, or at least a quantity of which should always be kept, in pots in the nursery.

I would beg leave, however, to recommend to every nobleman and gentleman who is at a great distance from a public nursery, where the carriage of large plants becomes expensive, and the long package often injurious, to get them in a young state and plant them in a nursery in their own premises, and when they arrive at a sufficient size they are then ready to plant out at any time when the weather is suitable for that work. Of the kinds raised from seed, such as have been one or two years transplanted out of the seed-bed, and of the kinds raised from cuttings, such as have been one year transplanted, I conceive to be of the most desirable size to order. The way that I have practised in nursing such plants, and which I have found to answer remarkably well, is to plant them out in rows in the nursery-ground at such distance between each row, and between each plant in each row, as will enable them to stand without being too much crowded at the end of the first year, and some sorts that are of slower growth may stand two

years before it is necessary to remove any of them. At the end of the first or second year, as it may be found necessary, every other row should be taken out, and, in some cases, every other plant in the row, and either planted out where they are to remain, or, if not considered large enough for that purpose, they should be planted in a piece of nursery-ground as before. The following year they should be again thinned upon the same plan; and this thinning may be repeated yearly for several years, till the plants that still remain attain a considerable size; and, although they have never been removed since the first planting, they are nearly as well prepared for removal as if they had been several times removed during the interval; for, by taking out the alternate rows and the alternate plants in the rows, the roots of such as remain must have been partly cut every year, thus compelling them to make fresh fibres, which is the object sought from their repeated removal.

Every person that has had any experience in planting evergreens must know that if they are allowed to stand long in the nursery without being transplanted (unless the foregoing practice is followed) there will be a much greater risk of failure when they are at last planted out; that this risk is greatly lessened by their having been frequently transplanted before. Every person that has a great extent of ground to plant with evergreens should get a quantity from the nurseries every year and nurse them as I have recommended, and then he will always have a succession coming forward; and when plantations of forest trees are about to be made, he will have it in his power to add infinitely to their beauty, by forming an underwood of *holly*, *portugal laurel*, *common laurel*, and *arbutus*. These would prove ornamental in the highest degree, would be excellent shelter, an exceedingly good cover for game, and, after they arrived at a certain age and size, would produce abundance of fruit or berries; and if it be ascertained that pheasants are fond of these fruits (as I know most other birds are), then they would produce food for them at a time when other food is scarce. I know that nurserymen in general are too enlightened and liberal-minded men to suppose that the practice I have recommended (even should it be adopted, which I fear it will not) would, in any way, hurt their trade. I am of opinion that the trade would be much benefited and the country much improved by it, because that every year an immensely greater number of evergreens would be planted. People soon tire of ordering evergreens year after year, when they find many of them die and many others remain sickly for years after planting. It is not unnatural that they should persuade themselves that it is the soil or climate that does not suit them; and then, of course, they cease to order more. I happened to be at a gentleman's seat in the month of July, 1825. In the spring of that year they had planted 500 Portugal laurels, which had been got out of a sale nursery, and when I saw them in July there did not appear to be 100 plants alive out of the whole, and not more than one-half of them were in good health—the others could not attain, for several years, the size they had reached when they were planted.

I do not intend to say anything on the raising of evergreens from seed or cuttings, as that seems to be quite as well understood by others as by me. I may be allowed, however, to mention that the same practice should be adopted in planting out of the seed-bed or cutting-bed as I have recommended when the plants are grown up, with this addition, that the roots of seedlings should be laid in puddle as soon as they are taken out of the ground, and then taken out of the puddle as they are planted. This will completely prevent the roots from getting dry during the time they are out of the ground; but it is also necessary to water them, for the watering keeps the ground in a moist state until the plants have got a sufficient hold of the ground to prevent them from suffering from dry weather which may follow. This practice would be an additional expense to nurserymen in planting, as a man could not plant near so many in the same time as he would do in the ordinary way; but from what I have done myself, and what I have seen others do, I am satisfied that the superior success of the plantation afterwards will more than repay the additional expense that may be incurred for labour in planting.

It may not be out of place here to mention that I consider it generally useless and, in most cases, as practised, hurtful to water in dry weather, during summer, evergreens which have been planted in spring. I am satisfied that in most cases more injury is done by watering in dry weather than by leaving the plants to their fate; besides, all the labour is saved and sometimes the plants also. It is a very common practice, when plants are supposed to want water in dry weather in the summer, to give them a little in the evening, from the rose of a watering-pot, so little that it does not penetrate into the ground an eighth part of an inch, and this is repeated two, three, or four times a week, as the state of the plants may seem to require. By this practice, the ground on the surface, from the hot drying sun through the day, gets hard and caked, which prevents any plants from thriving well; besides, not a drop of this watering ever reaches the roots of the plant, and therefore I consider it worse than useless. When watering in such weather is deemed necessary let it be done effectually, so as to reach the roots of the plant, and as soon as the water has dried up on the surface, let the whole part, as far as the water has extended, be regularly stirred over with the teeth of a rake. What I fear will not be believed is that in most cases in which artificial watering is necessary in the summer, a wet day ought to be selected for performing it, both for the sake of expedition and for the safety of the plants. It will, I know, seem a very foolish direction, and he will be called mad who says it is most beneficial to water plants while rain is falling abundantly; nevertheless, I am willing to stake my reputation for a moderate share of common sense upon it: I speak not theoretically, but practically. It has been my uniform practice, and I have for years seen its advantages. It is also necessary to observe that we must not think ourselves at liberty to stop short of drenching the lowest roots because it rains at the time. After such watering, if a little fresh earth can be laid over the surface, so much the better, but the

ground about the plants must never be left without being stirred over as soon as it gets a little dry; the practice is equally good, either in regard of old or of young evergreens.

I consider it unnecessary to mention any other evergreens than those I have already named, because they all require nearly similar treatment. *Rhododendrons* and *Kalmias*, however, may be lifted with perfect safety in autumn, winter, or spring, in wet weather or in dry weather, for when they are in ground that they thrive well in, they may be lifted with balls of earth, so large as scarcely to admit of their roots being disturbed; but at whatever time of the year they are planted, they, like others, should be well soaked with water, as already recommended.

There is but one reason why these evergreens are not more generally cultivated, namely, the expense in the way they are usually managed. Many, I am convinced, would not object to the expense of the plants themselves, but the difficulty and expense, in some situations, of procuring the soil which is represented as being essential to their well-being, prevents many from planting them to that extent which they would otherwise do. I shall, therefore, state here what will, in many cases, be found a cheap compost, and in which I find *Rhododendrons* and *Kalmias*, &c., thrive remarkably well, and, indeed, nearly all American evergreen shrubs, which are generally supposed to require, or are generally recommended, to be planted in peat earth. I say cheap, for when peat earth is difficult to be procured, and cannot be had at all, excepting from a considerable distance, it becomes very expensive. In many places, pit sand and vegetable mould, that is, the earth produced from the decayed leaves of trees, or other vegetable substances, or even rotted hot-bed dung, or a mixture of vegetable mould and rotted hot-bed dung, with sand, will answer equally well, and can often be got in abundance, where peat earth is scarce and expensive.

In good, fresh, hazelly loam, without any mixture whatever, *Rhododendrons*, *Kalmias*, &c., will grow and thrive perfectly. Indeed, if I may judge from the soil which adheres to the roots of imported American plants of these kinds, this is the kind of soil in which many of them are found naturally to grow at home. Many of them are also found in extremely thin strata of vegetable mould, over a subsoil of nearly pure sand. I never saw such peat earth, in which they are usually raised in this country, about the roots of imported American plants. As I never have seen any of the European species imported, I do not know what kind of soil they are found in; but I know, from experience, that in a fresh, hazelly loam some sorts will thrive admirably. Unfortunately, however, it is often as difficult to procure this kind of earth in Britain, and we have often to carry it as far as peat earth.

I, therefore, subjoin a statement of the proportions in which I recommend the substances I have spoken of to be mixed as a compost, in which to plant the delightful evergreens of which I am treating, and which every person, fond of horticulture, or "arbori-

culture," must desire to see greatly extended throughout the country.

Take *Peat earth*,
Pit sand,
Vegetable moula, or *old hot-bed dung:*

Let these three be mixed in equal proportions, and by being frequently turned, let them be thoroughly incorporated. Where vegetable mould, or old hot-bed dung, can with difficulty be got in sufficient quantity,

Take two parts of *peat earth*,
One part of *pit sand:*

Let these be well mixed, as above directed; but if the peat earth originally contain no sand, but is as pure as that commonly employed for fuel, it should be mixed with an equal quantity of sand. This last compost, however, will require a longer time before it is fit for use; it should, at least, be exposed for one winter, and during that time frequently turned. Even where peat earth can be got in any quantity, pit sand should be incorporated with it, to form a soil for these plants; for, in such a mixture, I have always found them to thrive greatly better than in pure peat earth.

There is not a doubt that where abundance of the proper compost has been prepared, it is well to obey the directions usually given, and to form entirely of it the border or plat, by previously removing the original soil to the depth of one and a half or two feet. Where little compost is prepared, or its expense felt, even when reduced by the substitutes I have recommended, I would advise that holes or pits be dug, accommodated to the size of the plants to be put into them; that some of the compost should be thrown into the bottom of the hole or pit; and after the plant has been put into its situation (the hole extending three or four inches in all directions beyond the roots of the plant), this hole should be filled up with the compost. In this way, one or two barrowfuls, according to the size of the plants, will be sufficient for each. Whether the plants are thus put into holes or pits prepared for each, or whether the whole border or clump is made of prepared compost, a top-dressing, to the depth of an inch or two, should be thrown upon the surface every second or third year, as the roots of all these plants rise to the surface, and without this will suffer from dry weather during the summer months. This observation, however, is chiefly applicable to plants in shrubberies or gardens, where the surface is kept clean by hoeing and raking; when raised as underwood, in plantations where the surface is grassy, and where the leaves of trees or other vegetable matter are allowed to lie and rot on the surface, a top-dressing is quite unnecessary.

The soil recommended above for the formation of the borders, I should recommend in preference to any other for top-dressing;

but where peat earth is not to be had, or is expensive from its distance, I should suggest the following composition as very well adapted for top-dressing.

Take one part *vegetable mould*, *old hot-bed dung*, or *old tan*,
or *a mixture of all three;*
One part *pit sand*,
One part good *garden earth:*

Let these be thoroughly mixed together by frequent turning and exposure to the weather till they assume the appearance of one uniform mass of light sandy earth. This will form an excellent substitute for the former compost in top-dressing; and, indeed, I can assert from experience, that an abundant supply of such, completely incorporated and pulverised, will render us nearly independent of peat earth in cultivating these greatest ornaments of the garden or of underwood.

The beauty of those plants as evergreens, and the splendour of their flowers in May, June, and July, make it certain that the value of the addition which a profusion of them would give to every scene must be appreciated by everybody. I cannot, therefore, but believe that, if the treatment and soil which I have recommended, and in which I can confidently assert they thrive admirably, be adopted, attempts would be more frequently made to fill the parks and forests of landed proprietors with them. They are perfectly hardy—I have never known them suffer from the severity of our winters—so that they are more hardy than the Portugal Laurel, Common Laurel, or Laurestine, which have been known to suffer in some situations. I at present allude to the Rhododendrons and Kalmias, and I may include Azalea and Rhodora, though not evergreens, and many other shrubs, known by the name of American plants.

I have drawn out these observations far beyond the limits to which I at first thought they would have extended; but I have had two objects before me, and I could not accomplish them in smaller space. I was anxious to convince gardeners that the treatment of evergreens, at present generally recommended and practised, is injurious to them; and I was desirous of pointing out to proprietors of ornamental parks and ornamental plantations that subjects which their taste must dictate as fit for such situations may be obtained with much more certainty, and at much smaller expense, than is generally believed.

The statements I have made are contrary to the opinions, and opposed to the prejudices, of many of my professional brethren, and I doubt not will therefore be received by many with displeasure; but if I have made use of one expression which is calculated to give offence, or to hurt the feelings of any in the profession, I have done it inadvertently, and I am sorry for it. To my younger brethren, in particular, I would urge the following advice:—Believe nothing implicitly on my authority; exercise your own judgments; take every opportunity which you can possibly command to put to the

test of experiment the statements I have made, and abide by the decision of facts. If, after sufficient experience, I am found wrong, then reject as useless, or worse than useless, all which I have written. If the method I have recommended have a patient, careful, and candid trial, I entertain not the least fear that I shall be found wrong. Be assured that my confidence does not arise from theory; my confidence arises from long-continued, extensive practice and the almost invariable success with which I have been rewarded. That field in which I have been lately occupied is open to the public; and I fear no attack from any critic who will suffer himself to be led, in the formation of his opinion, by the state of the evergreens in the Royal Botanic Garden at Edinburgh. I write ardently upon the subject, because I feel keenly upon it. I admire evergreens; I am anxious to see them diffused in crowds over the country; and if the measures I have advocated be followed, I do not despair of seeing my wishes in a great measure realised.

One word more, and I have done. There never was a time in which so much was supposed to be done for the education of gardeners as at present; there never was a time in which more was expected from them; and there never was a time when their employers generally were so capable of judging of their proficiency; therefore, there never was a time in which more exertion was called for from a young man who has any ambition to rise in his profession.

I honestly confess that I shall be proud if I find that any representations of mine shall have increased the cultivation of evergreens; and I am ambitious to have it believed that the whole of these observations have been dictated, as in truth they have been, by a wish to benefit, not to criticise, any of my brethren.

A List of Hardy Evergreens, a quantity of which should always be kept in Pots in the Nurseries, and none of which should be ordered by Gardeners to be packed, and sent to a distance, unless they have keen kept in Pots.

Arbutus Andrachne	Oriental Strawberry tree.
„ hybrida	Hybrid „ „
„ Unedo	Common „ „
„ „ crispa	Common curled-leaved Strawberry tree.
„ „ fl. pleno	Common doubled-flowered Strawberry tree.
„ „ fl. rubro	Common red-flowered tree.
Aristotelia Macqui	Shining-leaved Aristotelia.
Aucuba japonica	Blotch-leaved Aucuba.
Buxus balearica	Minorca Box-tree.
Cupressus lusitanica	Cedar of Goa.

Cupressus sempervirens - -	Evergreen Cypress.
„ „ horizontalis-	Evergreen horizontal Cypress.
„ „ stricta -	„ upright „
„ thyoides - - -	White Cedar.
Daphne Cneorum - - -	Trailing Daphne.
„ collina - - - -	Hairy „
„ Gnidium - - - -	Flax-leaved „
„ pontica - - - -	Pontic „
Erica arborea - - - -	Tree Heath.
„ australis - - - -	Spanish „
„ mediterranea - - -	Mediterranean Heath.
„ stricta - - - -	Straight-branched „
Ilex balearica - - - -	Minorca Holly.
Juniperus Oxycedrus - - -	Brown-berried Juniper.
„ phœnicia - - -	Phœnician Cedar or Juniper.
„ suecica - - -	Swedish Juniper.
„ virginiana - - -	Virginian Juniper or Red Cedar.
Laurus nobilis - - - -	Common sweet Bay.
„ „ salicifolia - -	Common willow-leaved Bay.
„ „ undulata - -	„ wave-leaved „
„ „ variegata - -	„ variegated „
Ligustrum lucidum - - -	Wax-tree Privet.
Magnolia grandiflora - - -	Laurel-leaved Magnolia, and all the varieties.
Mespilus Pyracantha - - -	Pyracantha or Evergreen Thorn.
Phillyrea angustifolia - - -	Narrow-leaved Phillyrea.
„ latifolia - - - -	Broad-leaved „
„ media - - - -	Privet-leaved „
Photinia serrulata - - - -	Serrulate-leaved Photinia.
Pinus canadensis - - - -	Hemlock Spruce-fir.
„ Cedrus - - - -	Cedar of Lebanon.
„ halepensis - - - -	Aleppo „
„ maritima - - - -	Maritime „
„ palustris - - - -	Swamp „
„ Pinea - - - -	Stone „
Prinos glaber - - - -	Evergreen Winter-berry.
Quercus coccifera - -	Kermes Oak-tree.
„ gramuntia - - -	Holly-leaved Evergreen Oak.
„ Ilex - - - -	Evergreen, or Holm Oak-tree.
„ Suber - - - -	Cork-tree.
Rhamnus Alaternus - -	Common Alaternus.
„ „ fol. argenteis -	„ „ silver-striped.
„ „ fol. aureis -	„ „ gold-striped.
„ „ balearicus -	„ „ round saw-leaved.
„ „ hispanicus -	„ „ Spanish.
„ „ latifolius -	„ „ broad-leaved.
„ „ maculatus -	„ „ spot-leaved.
„ hybridus - -	Hybrid Alaternus.
Thuja orientalis - - -	Chinese Arbor-vitæ.
„ plicata - - - -	Nee's „
Ulex europæus fl. pleno -	Double flowering Whin.

Ulex europæus strictus	-	-	- Upright Irish Whin.
Viburnum strictum	-	-	- Upright Laurestine.
„ lucidum	-	-	- Shining „
Yucca gloriosa	-	-	- Handsome Yucca, or Adam's needle.

I may insert here the following "Recommendatory Notices" of this treatise which the publishers had culled from contemporary sources and inserted on the cover of McNab's other treatise on "Cape Heaths," of which a transcript follows. They are germane to this account of William McNab in expressing the esteem in which he was held in his time :—

Recommendatory Notices.

"This is a highly meritorious production."—*Edinburgh Literary Journal*, November 27.

"Our limits will not allow us at present to follow Mr. McNab through all the details of his practice, but we must refer to the pamphlet itself, which will be read with pleasure by those who feel an interest in the propagation of evergreens, and not the less so by those who are acquainted with the unassumming manners and real worth of the author."—*Quarterly Journal of Agriculture*.

"This little treatise is, we do believe, an excellent compend of really useful information. We recommend it very strongly for perusal to all who have it in their power to ornament a little villa garden, or to plant extensive policy grounds and preserves."—*Edinburgh Advertiser*.

"We are quite assured, then, that this publication will be read with much interest when it is known that it contains a detailed account of Mr. McNab's practice, which is founded on very common sense principles, and that he proves beyond the possibility of dispute that the treatment which will secure similar success to every cultivator is both much more easy, and far less expensive, than the system of maltreatment commonly recommended and followed."—*Edinburgh Courant*.

"Mr. McNab is an assiduous observer and a clear-headed thinker. His work contains much truly novel information, delivered with that diffidence which always accompanies true merit. It is just such a book as a practical gardener ought to write. We hope that his remarks will be attended to by our landed proprietors, and that the cultivation of evergreens may increase. There is not a better cover for game than your laurel, and we know no more beautiful and appropriate ornament to a dwelling-house than luxuriant clumps of evergreens."—*Edinburgh Literary Journal*.

"Every man who knows anything of the Botanical Garden at Edinburgh has heard of Mr. McNab, its excellent superintendent. He stands, we believe, at the very head of practical botanists. In many respects the subject is interesting, though, thitherto, it would

seem, but little understood, and Mr. McNab's hints, confirmed by pretty long experience, are worthy of attention."—*Edinburgh Evening Post.*

"This is a little pamphlet, in a modest shape, with a modest name, but the object at which it aims is neither inconsiderable nor of partial interest. We have read it with much interest and with much pleasure. It is the work of a practical man, addressed to practical men; and being perfectly satisfied of the reality of the errors which Mr. McNab endeavours to expose, and of the correctness of the practice which he wishes to establish, we are most anxious that his opinions should be extensively known; and it is with this view that we have thought proper to notice a pamphlet which we are convinced every cultivator ought to study in detail." —*Caledonian Mercury.*

APPENDIX B.

A | TREATISE | ON THE | PROPAGATION, CULTIVATION, | AND | GENERAL TREATMENT | OF | CAPE HEATHS, | In a climate where they require protection during the winter months. | By WILLIAM McNAB, | Superintendent of the Royal Botanic Garden, Edinburgh; | Associate of the Linnæan and Medico-Botanical Societies of | London; | Corresponding Member of the Horticultural Societies of London | and Edinburgh, &c. | Author of "Hints on the Treatment of Evergreens." | EDINBURGH: | THOMAS CLARK, 38 GEORGE STREET. | MDCCCXXXII.

As Scotland is a country already famed for native heather, it may appear somewhat paradoxical for anyone to attempt to recommend methods for the cultivation of any sort, where much expense and labour is annually expended to get a part of the genus eradicated.

It must be allowed, however, that native heather is turned to many very useful purposes, for in several parts of the Highlands of Scotland it is frequently used for a cover for houses where scarcely any thatch can be procured; and I can state, from my own experience, that a dry bed of native heather is, to the weary traveller in many parts of the Highlands, a real luxury.[1]

Of the kinds of heather which I intend more particularly to treat of, we need be in no apprehension that any will ever be acclimatized in this country so as to withstand our winters; for, as I shall afterwards show, though many of the Cape heaths are able to withstand a considerable degree of cold, I have no reason to think, from the trials I have made, that any of them will ever be brought to stand out of doors, even in our mildest winters, and, therefore, they never can become a pest to the agriculturist; and even the European heaths, not natives of Britain, although they stand our ordinary winters without protection, do not seem to

[1] "The stranger's bed
Was there of mountain heather spread,
Where oft a hundred guests had lain,
And dreamed their forests' sports again;
Nor vainly did the heath flower shed
Its moorland fragrance round his head."—SIR W. SCOTT.

increase from seed with the same facility as our native heather does. *Erica carnea*, which has been cultivated in the British gardens about half a century, appears to be the hardiest of all the European species, not natives of Britain, and even more hardy than *Erica vagans*, which is found native in the south of England. I have frequently seen *Erica vagans* killed down to the surface of the ground; and I believe it will always suffer in this way, when the thermometer falls to 24 or 25 degrees below freezing,[1] unless the ground is covered with snow, or there is some other covering over the plant at the time. I have never seen this plant wholly killed from the severity of our winters; and if injured, it pushes away freely from the roots again in spring, though exposed to a much greater degree of cold than mentioned above. The severest frost to which this country has ever been exposed, in my own recollection, has never injured *Erica carnea* in the smallest degree, which is not the case, as I before mentioned, with *Erica vagans*, and hardy as *Erica vagans* is, I have never seen it come up from self-sown seed, as is the case with most of our native heaths.[2]

So much indeed has already been written on the cultivation of Cape heaths, that it may be supposed little remains to be said on the subject. I am convinced, however, from what little I know, that much is yet to be learned in the right management of these delightful plants. The directions given by our best writers on their cultivation are often at variance with each other, and where this is the case, the inexperienced cultivator must always feel himself at a loss to know which of those statements he ought to follow. For instance, one says they will not thrive without good peat soil to grow them in (Sweet); another, that with a very few exceptions, a good sandy loam is the best, and that peat soil is not necessary for them, but even proves injurious (Bowie). The same author says they will not thrive in earth finely sifted; another, that if any substitute can be found for peat earth for growing heaths in, it is in leaf mould, sifted very fine, and mixed with fine sand (Loudon).

Other contradictory statements regarding their culture might be quoted, but I shall content myself with endeavouring to show what I have, from long experience, found to be a method which, if followed, will suit those plants so as to bring them to a high state of perfection, and when in such a state they are allowed by all to form by far the most ornamental tribe of plants for the greenhouse at all seasons. I trust I may be excused for quoting here a passage, on this subject, by the conductor of the "Gardeners' Magazine," vol. I., p. 366. "Of what other genus can it be said, that every species, without exception, is beautiful throughout the year, and at every period of its growth—in flower or out of flower—and of every size and age? Suppose an individual had the penance imposed on him

[1] In alluding to the thermometer, as I shall have requent occasion to do, I shall always take that of Fahrenheit, which fixes the freezing point at 32 degrees, and will therefore mention the number of degrees be ow that point.

[2] A list of all the hardy heaths, both native and foreign, is given in the Appendix.

of being forbidden to cultivate more than one genus of ornamental plants, is there a genus he could make choice of at all to be compared to Erica?—perpetually green, perpetually in flower—of all colours, of all sizes, and of many shapes!"

From the supposed difficulty in the management of Cape heaths, the cultivation of them was certainly on the decline for several years. About thirty years ago, some very fine collections and fine grown specimens of heaths were to be found in the neighbourhood of London, and several sorts then in cultivation are not now to be met with. I may mention some of these collections, such as the *Royal Botanic Garden at Kew, George Hibbert's, Esq., at Clapham; E. A. Woodford's, Esq., at Vauxhall; J. G. Angerstein's, Esq., at Woodlands, Blackheath; Messrs. Lee & Kennedy, nurserymen at Hammersmith; Mr. Richard Williams, nurseryman, Turnham Green, &c., &c.*

Now, any person that happened to be about London at the time I have mentioned, and might have occasion to visit it now, will, I am sure, agree with me in saying that there are not to be found in the neighbourhood of that great city such fine grown specimens of heaths as were to be seen about the end of the last and the beginning of the present century. Of late years, however, they are more sought after, and particularly since that public-spirited nobleman, the Duke of Bedford, published his *Hortus Ericæus Woburnensis.* This gave a considerable stimulus, and his Grace's collection at Woburn is now considered the best in England, both in number of species and their high state of cultivation. Many, I am convinced, would follow this noble example if they knew that Cape heaths are as easily grown as any other hardy greenhouse plant.

In Scotland, we have had several private collections kept up in great perfection for many years. The principal of these are *Lord Douglass's at Bothwell Castle*, and *Walter Frederick Campbell's Esq., M.P., of Shawfield and Isla.* An account of the management of Cape heaths, by Walter Henderson, gardener to the last mentioned gentleman at Woodhall, is published in the *Caledonian Horticultural Memoirs*, vol. III, p. 323, which I consider by far the best I have met with on the subject. I trust, however, I may be excused if I have occasion to differ a little on some points on their cultivation from such a respectable authority—an authority from which, I am proud to say, I have learned much useful information as well on the cultivation of heaths as in many other departments of gardening; and I may state, without the fear of contradiction, that Mr Henderson stands at the head of his profession as a practical gardener, and, what adds much to his reputation, is always found ready to impart knowledge to every one in the line who is anxious to obtain it. It is but fair to mention that Mr Henderson is a man of that stamp that would not write on any department of gardening unless he could show the good effects of it in his own practice, and in which he has always ample grounds to bear him out.

Professor Dunbar, in this neighbourhood, has perhaps the finest private collection of heaths of any in Scotland, and in high perfection. A catalogue of them has already been published in the "Gardeners'

Magazine," vol. 1, p. 131. Of a more recent date, Mr Cunningham, nurseryman, Comely Bank, near Edinburgh, has by far the richest sale collection of any in Scotland, and, I believe, few even in England excel it.

If I shall be fortunate enough to convey intelligibly my ideas on the cultivation of this highly interesting genus, I doubt not but we shall soon see them greater favourites than they have ever yet been.

I am quite aware that it is no easy matter for a man to communicate in writing what he has acquired by long and continued experience, and more particularly, for one who has not been much accustomed to use the pen; all that I shall therefore attempt is, to point out as distinctly as I can, the treatment which I have found, from long practice and observation, to answer best. Any person who does not wish to cultivate a full collection of them, may have a selection of from fifty to one hundred sorts, which will flower in succession the whole year.[1] I may mention that it is a mistaken opinion, but I believe a very general one, that Cape heaths will not thrive well in a greenhouse, intermixed with other greenhouse plants; but I know, from experience, that Cape heaths will thrive quite as well in a green-house, well ventilated, with other hardy greenhouse plants, such as some of those from the Cape of Good Hope and New South Wales, as they will do in a house by themselves.

Pelargoniums, however, and several other soft-wooded and more tender Cape and New South Wales plants, will suffer when expoesd to a degree of cold, in no way injurious to the genus Erica. I know that the degree of cold which Cape heaths will bear in this country, without in any way suffering from it, is far greater than has been observed in the country where they are natives.

We know, from undoubted authority, that certain species of Cape *Geraniaceæ*, and certain species of *Ericæ*, grow together in the same kind of soil, and in the same situation, intermixed one with the other, in their native country; but we know that in this country the same species of heaths will bear a degree of cold with impunity, which will materially injure, and in many cases kill, the *Pelargoniums* growing beside them. Many similar examples might be stated, but I mention only the Cape *Geraniaceæ* and *Ericeæ*, being two families which almost every one is more or less acquainted with.

Almost all the Cape *Mesembryanthemums* will bear as much cold, without suffering from it, as Cape heaths will do. The former, however, although they will thrive perfectly well in a house kept at a temperature for heaths, will also thrive equally well in a house kept at a temperature for Cape *Geraniaceæ*. Though they dislike a high temperature, they are certainly not so susceptible of injury from it as heaths are.

To grow Cape *Ericeæ* and *Geraniaceæ* well together would require far nicer management than I profess to be acquainted with. I know, however, that heaths will bear a degree of cold in the greenhouse in winter (which, I am persuaded, is beneficial to their health)

[1] A list of these will be found in the Appendix.

that will materially injure Cape *Geraniaceæ*. If, therefore, a particular point is to be found, to which the thermometer may be allowed to sink in the inside of a greenhouse during a severe frost, which will preserve the *Geraniaceæ* from injury and not produce too much fire heat for the safety of the heath, it is one which I have never been able to ascertain.

I am speaking, however, of these two families, so as to have them in a high state of perfection. They may be both kept in the same house, so as to make a tolerable appearance, but, I believe, not in such a state of perfection as if they were in separate houses, for the fire heat that is absolutely necessary during severe frost in the winter for the one, is, as far as my observation goes, sure to be, in some degree, injurious to the other. When the construction of the greenhouse is such (and this is generally the case) that one end can be kept warmer than the other, in such a house the *Pelargoniums* should be kept at the warmer end and the heaths at the colder, and with good management, they may be grown in this way tolerably well. Although Cape heaths will thrive perfectly well in a greenhouse well ventilated, along with other hardy greenhouse plants, yet I have little doubt they will have a much finer appearance when grown by themselves.

When it is known how easily they can be grown, and how little expense is necessary for fuel in keeping Cape heaths in this country, many noblemen and gentlemen may be induced to build houses and appropriate them wholly to this delightful family. In order to state my observations in this essay as distinctly as possible, I shall divide them into the four following heads, namely :—

1st. The propagation of heaths, and the treatment of them when young.
2nd. The soil best suited for their growth.
3rd. The different shiftings necessary.
4th. The general treatment when in the house, or out of doors, when it is necessary to have them there.

I shall, therefore, proceed to treat of the first branch of the subject, viz :—

1. The Propagation of Heaths.

The general mode (and, indeed, the best) of propagating Cape heaths in this country is by cuttings ; but in all cases where seeds of good sorts can be procured, either saved at home or imported from abroad, particular care should be taken in raising them, for there is a great probability of new varieties being produced, especially from seed procured in the heath houses of this country.

How far the disputed opinion may be correct, that cuttings or grafts, taken from an old and worn-out plant, cannot survive much longer than the term of life allotted by nature to the original plants from which these cuttings or grafts were taken, I shall not now stop to inquire ; but I may state, from my own observation, that I know

of no instance in heaths where they may not be grown as healthy and vigorous as they were the first day they were introduced into this country, where the same individual species has been successively propagated from cuttings for upwards of twenty years.

I find the greater proportion of heaths strike root freely when the young wood is taken, after it has become sufficiently firm, so as to prevent its damping off. The pots for the reception of the cuttings should be about nine or ten inches in diameter at the mouths. It is a good method, in preparing the pots for the cuttings, to fill them to within one inch and a half of the top with broken pots or coarse ashes, the upper part of which should be of a smaller size than those below, over which should be put a thin layer of fog (hypnum), to prevent the sand from working down among the draining; then the remainder of the pot should be filled with fine sifted sand to the level of the edge, and the sand pressed down very firm. After being well watered, the pot is then fit to receive the cuttings. I prefer pit sand for striking heath cuttings in; the colour of it is of little importance, whether white, grey, or yellowish; it should, however, be as free as possible of earthy and irony matter. The length of the cuttings must depend on the habit of the species. Of some of the free growing sorts, they may be about an inch and a half long, and from others that are of a more stinted growth, they may not exceed half an inch in length; in both cases they should be taken from the plant at the part where the young cutting sets off from the older wood. The leaves should be stripped off about half the length of the cutting, and the end should be cut clean with a sharp knife, or scissors. The cutting is then fit to be inserted into the pot prepared for its reception. In all ordinary cases, pots of the size I have mentioned will hold many different kinds of heaths. In extensive nursery collections, where great quantities of plants are wanted, one pot may be filled with cuttings of the same species, when such can be got in sufficient quantities; but in private collections this is not necessary, for a few plants of a sort, in general, are all that is required. When this is the case, the kinds selected to be put in the same pot should be as near of the same habit as can be judged of at the time. For example, I shall suppose four pots are intended to be filled with cuttings. Such as the following should be selected for each pot.

First Pot.	Second Pot.	Third Pot.	Fourth Pot.
Melastoma.	Pinea.	Ventricosa.	Aitoniana.
Petiveriana.	Pinifolia.	Prægnans.	Jasminiflora.
Petiveri.	Vestita.	Linnæana.	Ampullacea.
Sebana.	Grandiflora.	Linnæoides.	Irbyana.
Penicillata, &c.	Purpurea, &c.	Colorans, &c.	Inflata, &c.

Unless this is attended to, one sort will be found to strike root in a much shorter time than others in the same pot, which makes it more inconvenient when potting them out. This, however, must always happen to a certain extent, for a little difference in the age or firmness of the cutting, even when the work is performed by the

most experienced hand, will often make a difference in the time required to strike root. When the pot is thus filled with the cuttings, it should be well watered with a fine-rose water-pot and placed in a close shady part of the stove, admitting as little air as possible near to where the cutting pots are placed, and taking care to water them freely every day. Indeed, when put in this way, there is no risk of over watering them, for having them well drained, the water is allowed to pass freely through, and, so far from injuring the cuttings, they are benefited by it.

I am convinced that all Cape heaths will strike in this way when good cuttings can be procured of them. I very seldom use bell glasses for heath cuttings, nor do I consider them necessary for heaths in general. Some of them, however, which are more difficult to strike, such as *Erica glauca*, *aurea*, *taxifolia*, and a few other species, may be put under bell glasses and placed in the stove beside the others. Where no stove is at hand to put the cutting pots in, and where the situation in which they are to be placed has much air, then bell glasses are absolutely necessary. The pots, in this case, should be prepared for the cuttings which are to be covered with bell glasses in the same way as before recommended. The size of the pot must be regulated by the size of the glass which is intended to cover the cuttings. The glass, in this case, will require to be wiped occasionally to prevent any damp from injuring the cuttings; and when they have struck root, the glass should be removed gradually, some time before the cuttings are potted out. I am convinced that cuttings of heaths will strike root when put in at any season, if the cuttings are in a proper state, that is, when the young shoots are just old and firm enough to prevent them from damping off when first put in. Early in the spring, I judge, however, to be the best time for them; the cuttings will be rooted and potted out in sufficient time to get established in the pots before the following winter. Young cuttings and seedlings I consider very different in this respect from old plants. I shall hereafter show that old plants may be potted late in autumn, without suffering from it during the ensuing winter, but I have never found young cuttings or seedlings do so well if potted out late in the season, as at such a time as will enable them to get well rooted before the winter sets in. To those who may not already have had much experience in the propagation of heaths, I would recommend not to be discouraged although they do not succeed so well at first as they expected. Let them but persevere in their attempts and there is no fear of their ultimate success.

When the cuttings are rooted, which will be easily known by their beginning to grow freely, they should be potted into the smallest-sized pots and kept for ten days or a fortnight in a close shaded place; then expose them gradually to a more airy part of the house, taking care to shade them for a few hours in the heat of the day, if there happen to be much sun at the time. This shading should only be continued till the young plants are enabled to bear the full heat of the sun.

The soil for the first potting should be one-half peat and one-half

sand, always taking care to drain the pots well with small pieces of broken pots or cinders. The second potting must depend much on the season of the year; if the first potting is done in the spring, the second should be as soon as the young roots appear round the inside of the pots; but if the first potting is in the summer, then the second will not be necessary till the following spring. The soil for the second potting should be about two-thirds peat and one-third sand, and in all the after pottings the soil should be the same as will hereafter be recommended.

Having mentioned all that I consider necessary for the guidance of the inexperienced cultivator on the propagation of heaths from cuttings, I shall now say a few words on the treatment of those which are to be raised from seed. I am aware that *July* or *August* is the time recommended by some as the best for sowing the seeds of *Ericeæ*. The time, however, which I would recommend for sowing heath seeds is in February, or early in March. By sowing them at this season, we can always have the young plants sufficiently strong to stand the following winter. Whatever sized pots are used for sowing the seeds in, they should be filled, at least, two-thirds with broken pots or cinders, so as to have them well drained. The upper part should be filled to within one-fourth of an inch of the top with very sandy peat earth, and made level and firm; the seeds should then be sown on the surface, and scarcely any covering put over them. This precaution is absolutely necessary from the circumstance that the seeds of all the heaths are very small and unable to push through a deep covering. The pots, after sowing, should be watered with a very fine water-pot, and placed in a cold frame, under glass, where they should remain. They will require water every day, and if the weather be very dry, and much sun, they should be shaded with a matt for a time in the middle of the day. As soon as the seeds begin to vegetate, the frame should have a little air admitted to prevent damp, and this should be increased as the young seedlings gain a little strength. Whenever the plants are sufficiently large to bear handling without injury, they should be potted out into small-sized pots, always putting several plants in the same pot, particularly near the edge of it, as some of the seedlings may be expected to damp off in the first potting. The soil best suited for them is the same as for cuttings, namely, one-half peat and one-half sand; they should then be treated in the same way as is recommended for the cuttings when first potted out. I now come to the second part of the subject.

II. The Soil best suited for their Growth.

The soil which I have found Cape heaths thrive best in is a black peat soil taken from a dry heath, or common, which is never overflowed with water. In general, it should not be taken off more than five or six inches deep. This, however, must partly depend on the subsoil; for, in some cases, I have seen, at twelve or fourteen inches deep, the soil quite as good as at the surface. Whatever heath or other vegetable production is on the surface should be taken along with the peat earth to the compost ground, and there laid up into a heap

till wanted. It frequently happens that peat earth, taken from such situations as I have mentioned, has sand intermixed with it in its original state; but where this is not the case, a quantity of coarse white sand should be procured and mixed with the earth in the compost ground. This should be, at least, to the extent of one-fourth or one-fifth of the whole, and although a little excess of sand is used, it will never be found injurious to the health of the plant.

I prefer a coarse white sand, when such can be procured; but when that cannot be had, any coarse pit or river sand will answer equally well, and where an opportunity offers of procuring sand from free-stone quarries, or from the hewings of such stones used in buildings, it will answer equally well; but in either case let the sand be free of irony matter. When the earth and sand are properly mixed, I consider the compost fit for use.

I am aware that some difference of opinion exists on this point, some maintaining (perhaps such as are advocates for using vegetable manure in a fresh and green state) that peat earth is always best when taken fresh off the common and used immediately. Others consider it better after having lain for a year or two in the compost ground, and been turned over occasionally during that time; but, from practice, I have found no difference whether it is used immediately when brought from the common, or after it has lain for years in the compost ground. Care, however, should always be taken to have the compost ground in such a situation where the roots of trees cannot reach the earth during the time it lies there. The situation should also be dry and airy.

I am persuaded that we have as good peat earth in Scotland for the cultivation of heaths as is to be found in any part of Britain; and plenty, of superior quality, is to be had at no great distance from Edinburgh. Yet it is, nevertheless, true, that not more than thirty years ago, for all the Cape heaths that were grown about Edinburgh, peat earth was brought from the neighbourhood of London.

I have tried various soils to grow heaths in, but I have found none equal to the kind I have just mentioned, having grown them in it to greater perfection and seen them live longer than in any other I have tried.

There are, in the Botanic Garden at Edinburgh, heaths grown in the above-mentioned compost eight feet high, in tubs three feet over, and the plants are both bushy in proportion to their height and in great vigour; and these, when in flower, are covered with blossoms from the edge of the tubs to the top of the plants. These are, however, the freer growing kinds, such as *Erica Ewerana*, *Bonplandia*, *abietina*, *vestita-coccinea*, *grandiflora*, &c.

The dwarf growing kinds, such as *Erica depressa*, *atrosanguinea*, *petiolata*, *rupestris*, *Banksii*, &c., &c., could not, under any management, be grown to the above size. I may mention that I have used a small quantity of manure in the foregoing compost with very good effect, about one-eighth part of cow-dung. This should be well rotted before it is used. The way that I have always prepared this dung before using it is to take a barrow load of it and place it in

thin layers between layers of peat earth, and after it has lain for some time, chop the whole up together, and turn it over at intervals, till the dung disappears, and the whole mass assumes the appearance of black peat earth and sand; and where this manure is applied, about an equal quantity of sand should be added (that is, about one-eighth part of the whole) in addition to the sand that I have before recommended to be mixed up with the earth. This, I know, can be used with very good effect; but, for all ordinary purposes, I consider it quite unnecessary, as there is no difficulty in growing heaths very soon too large for the accommodation that is generally allotted for them, with the compost that I have mentioned without manure. I merely mention this, because I know it is the opinion of some that heaths will not thrive with manure added to the peat earth in which they are grown.

I know, however, that some heaths may be grown to a larger size, in the same space of time, with manure than without it; but, as I have already mentioned, I consider it quite unnecessary for all ordinary purposes, and any person who wishes to try its effects should do so very sparingly at first, till he is enabled to judge of the effect produced by it, as a little excess of manure is sure to injure the plants. Perhaps liquid manure might be used with very good effect for growing some kinds of heaths; but I am unable to give any particular directions in what proportion it should be used, as, from what trials I have made, I cannot come to any certain conclusion. But this much I know, that whoever wishes to try it, should do so at first with great caution, with quite as much as in using an excess of manure in its solid state.

This, however, is wandering from my original purpose, as I do not intend to advance anything but what I can support from practice. I shall, therefore, proceed to the *third* part, viz.:—

III. The Different Shiftings Necessary.

In shifting heaths from one pot or tub to another, I take any time from *March* till *August*, as opportunity will permit, or the state of the plants require. I have shifted heaths as late as November, and they have done quite as well as those repotted in summer. This time, however, is, in general, quite unnecessary, unless in the case of broken pots or other accidental circumstances, or in the case of heaths being planted in the open ground in the summer. If any of them should be required to be put into the house in winter, they may then be taken up and put into pots in the autumn, before the frost sets in very severely; but, unless under particular circumstances, it is quite unnecessary to shift heaths late in autumn, and I merely mention this to show that there is no danger to be apprehended from doing so at that time. I am aware that many say that heaths should be shifted in spring, or early in summer, in order that the pots or tubs may be filled with roots before the winter sets in; but if treated in the way I shall recommend, they will do just as well when shifted late in the summer as at an early period, and even in autumn, when necessity requires it.

Before beginning to shift, I have a quantity of the soil already mentioned riddled through a very coarse or wide-meshed riddle (if the plants are small, of course the riddle should be finer). I would always recommend the earth to be riddled, because it mixes the earth and sand much better than chopping can do; and if it has lain for some time in the compost ground, nearly all of it will pass through the riddle, but what little does not pass through, I keep to put in the pots over the draining. I use either broken pots or cinders for draining, whichever is most conveniently obtained. The latter I see is objected to as a drainer for some plants (*Gardeners' Magazine*, vol. 1, p. 224), but, from practice, I have seen no bad effects from using cinders for draining, and I know heaths thrive as well and their roots matt as freely among cinders as they do among potsherds. This, I think, is important to know, for the quantity of draining I use, and which I find quite necessary, for the growth of heaths is such, that to grow a large collection of them to a great size, would require a person to be in the neighbourhood of a pottery or brick work to get a sufficient supply. I always use plenty of draining. The largest-sized pots or tubs should have from three to four inches deep, and the smaller pots about the same in proportion to their size. There is scarcely any danger, indeed, of giving too much draining. When this is done, and the plant raised a little higher in the pot at each shifting than it had been before, that is, after two or three shiftings, the old ball about the stem of the plant should be raised two or three inches above the level of the edge of the pot or tub, keeping sufficient depth between the old ball of earth and the edge of the pot or tub to hold water. The annexed sketch will show the appearance of the plant when treated in the way I have recommended.

This is not a new practice, nor, if it were, is it one of my own invention; but from the good effects I have found result from it, I believe it is not so generally adopted as it ought to be. I was urged to adopt this practice upwards of twenty years ago by an eminent practical gardener, but, like many other inexperienced gardeners, I felt great reluctance in putting it in practice, for no other reason than that I fancied the plant looked as if it were ill potted, and, to my view, unsightly.

It would be foreign to my purpose at present to speak of any other plants but heaths. I may mention, however, briefly, that almost all the natural family of *Proteaceæ* are benefited by being treated in this way.

When the upper part of the old ball of earth and the stem of the plant are raised above the level of the edge of the pot or tub, as I have directed, there is scarcely a chance of the plant suffering from too much water being given it, even in winter; for, if by chance it does get too much, it can only be round the inside of the pot or tub, and at the extremity of the roots, the upper part of the old ball of earth and the stem being always so much higher, that the water runs down to the edge of the pot or tub, and the quantity of draining below will always keep the plant from suffering from a superabundance of water. It is also of advantage in winter to have the pots or tubs

raised on three pieces of wood, or bricks, above the level of the stage; this I consider beneficial to the health of the heath in winter, as well from its allowing a freer circulation of air under the pots or tubs, as from the increased facility with which a superabundance of moisture is allowed to escape freely from the pot or tub. I am convinced that heaths suffer more in the winter when grown in the ordinary way, from too much water and too much fire heat, than from any other cause whatever. But of heat I shall speak hereafter. In shifting heaths, I never reduce the old ball of earth more than by rubbing the sides and bottom with the hand, so as to loosen the outside fibres a little. I have often shifted heaths twice, and even three times, in the course of the spring and summer, with the greatest success. It is, however, quite unnecessary to shift a heath until the young fibres have come through the fresh earth given to it at its previous shifting, and begun to extend themselves round the inner edge of the pot or tub; but as soon as this takes place, they may then be shifted with advantage. This frequent shifting, however, is quite unnecessary, unless it be to encourage a favourite specimen; for in all ordinary cases, particularly when the plant is large, I consider one good shifting in two or three years quite sufficient. But in this case, when the plant is healthy (and it is quite unnecessary to shift it into a larger pot if it is not), I give it a much larger pot or tub than it had been grown in before. I am aware that this is contrary to the ordinary practice, as most people agree that heaths should not be put into a much larger pot than that from which it is to be removed; or, as gardeners would say, they should not be *over-potted*. Nevertheless, I know, from experience, that it is a good practice, and a great saving of labour, as all our large heaths are grown in tubs, some of them three feet over and two and a half deep.

These tubs are all made with iron catches, two on each tub, opposite to each other, and fixed on with strong rivets above the upper hoop. Two bent-iron handles are made to fit into these catches to lift the tub. These are all of the same kind and same size, so that the same pair of handles answers for lifting all the tubs.

When any of the plants in these tubs require shifting, they cannot be turned out by turning them upside down in the way practised in shifting plants in ordinary sized pots; all that is necessary with the tubs is to number the staves with a piece of chalk, and as the catch for the handle is above the upper hoop, the hoops can easily be driven off with a cooper's iron; the plant may then be lifted into the other tub prepared for it, and the tub out of which it has been taken may again be put together, and will answer a smaller plant.

Small tubs for plants will be found cheaper in the end than very large sized pots, for, under the most careful management, large pots are liable to get cracked or broken, particularly at the time of shifting; and I have seen no instance, either with heaths or any other plants, in which they have not thriven quite as well in tubs as in the best earthenware pots that are made.

In an oaken tub, with three good coats of paint on the outside and a thick coat of pitch or coal tar inside (and, in some cases, the tubs

we used were made out of oil casks) when, to all appearance, it is as impervious to moisture as even a glazed earthenware pot, but in such a tub I have seen no instance in which heaths did not grow as freely as in ordinary flower pots; and yet, though I have repeatedly made the experiment, I have seen no instance of a heath thriving in a hard burnt earthenware pot.

Besides the compost and draining which I have already mentioned, when I begin to shift heaths I have always at hand a quantity of coarse, soft, free-stone, broken into pieces, from an inch to four or five inches in diameter. Of these I always introduce a quantity among the fresh earth as it is put into the pot or tub, round the old ball of earth about the plant, and press them well down among fresh earth as it is put in. This I consider of great advantage to all sorts of heaths, but more particularly so to those that may have been shifted into a much larger pot or tub at once than what it had been grown in before, or in what I would call biennial or triennial shifting. These pieces of stone may be put in as large as the opening will admit between the old ball and the edge of the pot. In some of our largest tubs this opening is full four inches wide, and where much earth is required to be put in the bottom over the draining before the plant is put in, a quantity of these stones should be mixed with the earth also. I likewise use occasionally large pieces of soft burnt broken pots, put among the earth in the same way as the stones; but I prefer stones when I can procure them soft and free of iron. The quantity of stones which I introduce along with a large-sized heath at shifting, will, in most cases, if broken down into sand, and added to the sand previously in the soil, form about one-third part of the whole mass. When stones are introduced among the earth in the way I have recommended, heaths will never suffer so much in the summer from occasional neglect to water them as they would do if the stones were not introduced; because these stones retain the moisture longer than the earth, and in the winter they allow a freer circulation of any superabundant moisture which may be given through the mass.

I am aware that Mr Bowie (*Garaeners' Magazine*, vol. 1, p. 364) recommends small pieces of stones to be mixed with the earth in which heaths are grown. I may mention, however, that it was practised here long before Mr Bowie's paper appeared, which can easily be shown by examining the ball of earth of any of our oldest heaths in this garden.

What induced me first to try stones mixed with the earth were hints received from another meritorious collector now no more. But I shall have occasion to mention his name hereafter, as having received from him many other useful suggestions regarding the cultivation of heaths. It is but fair, however, to state that Mr Bowie, as far as I know, was the first to recommend this practice in print. Although the use of stones among the earth for growing heaths has been practised here more than ten years, and I have seen pieces of broken pots used in the same way, and for the same purpose, about London nearly thirty years ago, it cannot, therefore, be considered an invention of Mr Bowie's, and certainly it is not one of mine.

This, I believe, is all I can say of importance on the soil and shifting of heaths; I shall, therefore, proceed to the *fourth* and last part of this essay, and the one which I consider the most important of all, being convinced that no man will ever grow heaths well unless the practice I am now to recommend, or something similar to it, is attended to, namely:—

IV. The General Treatment of Heaths when in the House and out of Doors; when it is necessary to have them there.

Many of the following observations were derived from hints communicated to me in repeated conversations on the culture of Cape heaths with my much lamented friend, the late Mr James Niven, who certainly knew more of the nature and culture of that genus than any other man I ever met with. It is well known that Mr Niven was upwards of ten years at the Cape of Good Hope as a collector, and was well acquainted with all the situations in which they are to be met with in that country.

For many years before his death Mr Niven resided in the village of Pennycuick, in the neighbourhood of Edinburgh, where he rarely met with a Botanical friend. He died at Pennycuick on the 9th January, 1827.

Mr Niven's *Hortus Siccus* of Cape *Ericeæ* is now in my possession, and contains many species never yet introduced into Britain; at least many that I have never met with in cultivation. I beg it to be understood, however, that all I have hitherto stated, as well as what I am now going to recommend, is not the mere theory of Mr Niven, or of any other man, but is founded on my own successful practice.

When I mention the treatment heaths should have when in the house, I must let it be understood, that if I had sufficient accommodation under glass, I never would take heaths out of doors, unless it were for the purpose of shifting or taking them from one house to another. My practice would be to keep them in the house in the summer, giving them plenty of air, and to keep them cool during winter. I know it is the common practice to turn heaths out of doors for four or five months in summer and autumn, and it is also a pretty general opinion that by doing so it makes them hardier and enables them to stand the winter better than they would do if kept within doors during summer. From this opinion I must take the liberty of differing, as I know of no species of heath that will not bear as much cold in winter, without suffering from it if kept in the house during the summer, as they would do if they were turned out of doors, and many of them (perhaps all), I know, will bear more cold in the winter if kept in the house during the summer. For, by the latter practice, the young wood gets better ripened and better able to resist cold in the winter. It would be travelling out of my way at present were I to mention any other plants but heaths, but I may be allowed briefly to mention that heath is not the only genus among our greenhouse plants that is benefited by this mode of treatment. It is, however, unnecessary to dwell longer upon this, because no

place that ever I have seen has sufficient accommodation to keep the whole of the collection under glass during summer; for unless they are placed quite separate from each other, so that a free circulation of air can pass among them, they will suffer much more when crowded in the house in the summer than they will do in the same situation during the winter; for in winter they are in a more dormant state, and not growing with the same vigour. I would, however, advise every one to keep as many of their best specimens and best kinds within doors during the summer as they can, without having them crowded close together. I cannot give better directions than to say that one should not touch the other when in the house in summer, and if the nearest part of one to the other is two or three inches apart, so much the better. The house, however, should be well ventilated at all times, and, except in cases of high wind or heavy rain, both top and front lights should be open night and day; and besides watering the earth in the pots freely when they require it, they should be well watered over head with the garden engine every day, and if the weather is hot and dry this operation should be performed twice every day, namely, both morning and evening.

It is very seldom that heaths are attacked with any insect; the green fly is the only one I have observed, and this very seldom; but when it does happen, a little tobacco smoke for a night or two, when the house is shut close, will readily destroy it, and when this is necessary, it is always better to apply it for two nights in succession in a small quantity than to give too much at once. The same quantity of tobacco, if used for two nights in succession, will have a better effect in clearing the house of the insect than if used all at once.

I am aware it is supposed that heaths do not like the smoke of tobacco; but I have never seen them suffer from it, and I believe it will never injure them if too much is not used at one time. It answers all the purpose wanted, that is, in destroying the insect, by giving a little at two times, in place of giving a great quantity at once, and thus no risk is run of injuring the heaths. I never have seen heaths injured by tobacco smoke, even when a strong dose was applied; but it is always best to avoid extremes, for although I have not seen any injury arise from it, I do not mean to say that other people may not have observed it; and, therefore, the safest way is to use little at a time.

Part of the heaths which are intended to be turned out of doors during the summer should be removed as early in the spring as the weather will permit, as I have already said it is much more injurious to have them crowded in the house in spring, when they are in a vigorous state of growth, than during winter, when they are in a more dormant state.

If the weather be favourable, a part of them may be turned out towards the end of April, if a sheltered, shady situation is at hand to place them in. I may mention, that at this season, they should always be placed in a situation well protected from the easterly wind, for they will suffer much more from it after being turned out of the house in spring, if not well protected, than what they will do from a sharp frost late in autumn. Another part may be taken out of

the house in May, and by the middle of June the whole that is intended to be removed for the season. At whatever time they are put out, always choose, if possible, a moist dull day, and when this cannot be got, place them in a shady situation for some time, till they are enabled to bear the full rays of the sun without suffering from it. They should then be placed in the greenhouse ground, taking care to keep them at a sufficient distance from each other so as not to be in any way crowded together. Let them be plunged in the ground from two to six inches deep, according to the size of the pots. This saves much labour in the summer in watering, and it also keeps the plants from being blown over by the wind; and I have seen no injurious effects arise from it. Besides, the saving of labour in watering is far more than over-balanced by the time that is occupied in putting them in. Care, however, should always be taken to keep the bottom hole in the pot open so as to let the water pass freely through. Such plants as are in tubs, turned out in the summer, I never plunge in the way the pots are done; not from any fear of injuring the plant, but the tub. In place of plunging it, I raise it an inch or two above the surface with three pieces of brick, or pieces of wood, of equal thickness; for, in this case, the saving of labour in watering would not compensate for the injury done to the tub; and if the tub is large, no danger need be apprehended of its being blown over with the wind. The plant, however, should be well secured with stakes, to prevent its being broke by the wind. If plenty of coal ashes is at hand, a little may be put under each pot, to prevent worms getting into them, although I have very rarely seen worms get into the heath pots through the quantity of draining I use. The plants should be regularly looked over every day, and such as want water should be supplied with it; and if the weather is dry, they should be watered over head every day with the garden engine. During the summer this should always be done in the evening; but late in the autumn, what water they may require, either from the water-pot or the engine, should be given in the morning. Any of the plants out of doors, that may come in flower late in the season, should be removed into the greenhouse, as the heavy rains and high winds injure their appearance when in flower.

Although I have never seen heaths injured here by frost when fully exposed to the weather, till after November, it is then necessary to have them moved into the house; and to prevent the heath-house being crowded too early, a part of the duplicates may be left in an open shed, if such is unoccupied at the time, until the thermometer falls 7 or 8 deg. below freezing, as we have seldom such a cold here till past the middle of December. It is then necessary to move the whole into the house that is intended for them. In all cases, in the middle of winter, heaths will sustain no injury in the house, with the front lights open both day and night, until the thermometer falls more than 8 deg. below freezing. I would not, however, advise this to be practised in spring, in case of the same degree of frost happening at that time; for we have often mild weather in February and March, and so much sun, that the heaths are forced into a more vigorous state of growth than they

are in winter; and when in such a state they will not bear so much cold without suffering from it as they will do in the early part or middle of winter. For instance, in the spring of 1830 we had the thermometer, on the morning of 2nd April, 10 deg. below freezing.

I have had the whole heaths in the house frozen for days together so hard that the pots could not be removed from their places without breaking them, and fresh air constantly admitted at the time, and I have never seen one of them suffer in the smallest degree from it; but, on the contrary, found them thrive better than under any other treatment.

I have several times had the heath-house in winter without fire heat when the thermometer out of doors stood at 16 deg. below freezing. But in these cases the house was always shut close, and I have never seen the heaths suffer from this cold. I would not, however, advise any person to risk his heaths in such a temperature until he had himself tried some experiment on the degree of cold which they will bear; and from that he will learn more than he could from volumes written on the subject. A very little observation will soon convince him that heaths require but little fire heat during winter. When I mention fire heat I consider the mere matter of heat the same, whether derived directly from fire or from water or steam-pipes, provided that smoke and steam are excluded.

I have already said that heaths suffer from too much artificial heat, and all that I have read on their cultivation seems to concur in this particular; but I am not aware that anyone has pointed out what degree of heat or cold is injurious; and I have, indeed, only been able to ascertain this myself to a very limited extent.

The time, however, when these plants suffer most from heat is when a sharp frost sets in and no heat is applied till after the frost has taken effect in the inside of the house. Then a fire is put on, and the frost is driven out. It is better, no doubt, in such a case to keep out the thief if you can; but if once let in, keep him in and never attempt to force him out. We know that heaths in the open air will not suffer when the thermometer stands 4 or 5 deg. below freezing; and we know also that heaths in the house in winter will bear the same degree of cold with impunity. Now we shall suppose the thermometer out of doors to fall to 12 or 14 deg. below freezing, and no heat in the heath-house; the thermometer in the inside may then be 4 or 5 deg. below freezing. If there be no appearance of a change, then it is necessary to apply heat to the house; but all that is wanted in this case is just enough to keep the temperature from getting lower than it was when the heat was introduced. Suppose the thermometer to sink to 18 or 20 deg. below freezing during the night, the instrument inside should range as near as possible to what it was when the heat was applied. This, however, requires very particular attention. From what I know, heaths will suffer if, after the thermometer has fallen 4 or 5 deg. below freezing inside of the house, heat is added so as to raise the temperature and drive out the frost during the time the thermometer is still sinking out of doors. It would be much better if the house were left without fire heat, even

with the thermometer out of doors 15 or 16 deg. below the freezing point. Such treatment is bad for all plants, but more particularly for heaths. If we were certain that the thermometer during the night would not sink more than 10 or 12 deg. below freezing out of doors, no artificial heat whatever would be necessary in the heath-house.

It is an excellent practice in dull weather in winter, and even frosty weather, if much damp is in the house, to throw in a little heat during the day, but this should never be done unless the weather is such that plenty of air can be given to the house at the same time, nor even when frost is in the house; and the heat should always be stopped before the air is taken off. This, however, is unnecessary unless the plants appear to suffer from damp. Very little water should be given during frost, indeed none, except to those which appear to suffer from want of it; but in mild, dry weather they should be watered freely with the watering-pot, and the engine should also be used once or twice a week, according to the state of the weather; that is, when it is dry and mild, with much sunshine.

It is a very general opinion that heaths will not thrive in a low and damp situation. This, however, is so far incorrect, for heaths will thrive quite well in such a situation where the house can be well ventilated and attention paid to drying up the damp during the day in the way I have directed. Indeed, in pits covered with glass, if we had the power of keeping them free from damp in such a situation, we could keep heaths perfectly well without fire heat by covering the glass during severe weather with straw or matts. The glass covering is quite sufficient to protect them from injury until the thermometer falls more than 7 or 8 deg. below freezing; and then it is advisable to apply some additional covering. The woolly-leaved kinds, such as *Erica Massoni*, *gemmiflora*, *bruniades*, *pubescens* &c., are very liable to suffer in such situations. It is, however, very difficult to lay down any general rule for this, further than by mentioning particular species that have been tried; for *Erica ferruginea*, which is very similar in habit to the two first mentioned species, that is, *Erica Massoni* and *gemmiflora*, will bear cold and damp to a much greater extent without suffering from it than these others will do.

I am aware that it is difficult to preserve heaths for any length of time without suffering in a dwelling-house; but this, I think, is easily accounted for, as in such situations they are never allowed a sufficiency of air, or, if they get enough at one time, they are totally excluded from it at another; and if it is during the winter, they are often shut up in the drawing-room, where the heat during part of the night is sufficient for our tenderest tropical plants, with perhaps a sharp frost out of doors. No wonder, then, that heaths do not thrive in such situations, and subjected to such treatment.

There is a very considerable difference in the degree of cold which Cape heaths will bear without suffering from it. Many of them will be much injured when the thermometer falls 8 or 10 deg. below freezing; many others will require 10 or 12 deg. below freezing to produce the same effect. A list of those which I have repeatedly

tried, as well those that are hardier as those that are tenderer, will be given at the end of this essay. This list, of course, is very limited, but still it is a beginning, and everyone that has it in his power may add to it from his own trials, or prove, for his own satisfaction, those which I have tried. In every collection where heaths are grown to any extent there must be several every season which will be ejected from the house, either for want of room or from being unsightly, ill-grown specimens; and it is much better to plant them out or keep them in pots in the open air than to cut their heads off and throw them to the rubbish-heap as soon as they are condemned, particularly as this selection generally takes place at the end of the season, when the plants are put in the house. If kept in pots it cannot be much additional labour to keep them alive by giving them a little water until their executioner comes round, which will, in general, be some time in December; but not always so, for, on the 20th January, 1829, we had 29 species of heaths planted out which remained without injury till the 21st and 22nd January the same season. The thermometer then fell 14 deg. one night and 17 deg. the other below freezing, when they were all totally destroyed. The frost before that had never been more than 9 deg. below freezing, viz., one night in November, 1828. This, however, is the only instance that I know in which heaths stood so long without injury from frost. I have, however, known them suffer very little till the beginning of January; but, in general, we have here the frost sufficiently severe either to injure or quite kill them some time between the middle and end of December—very seldom earlier.

It must be understood, however, that I am speaking of the part of the country in which I reside. Of course, in other parts, if the thermometer falls 14 or 15 degrees below freezing in October or November, it will produce the same effect as such a cold could do in December. I have not, however, observed such a cold about Edinburgh till the latter month.

Any person who will take the trouble to treat his surplus heaths in this way will soon gain more information for himself on the degree of cold they will bear than he will be able to obtain from any author.

I have no wish to introduce the disputed question whether plants may be accustomed, after long cultivation, to bear more cold than when first introduced into this country from a warmer climate, or what we would call acclimatized. I know from experience, however, that young heaths, one, two, or even three years old, whether they are from cuttings taken from the old plant, or from seed produced by the same plant from which the cuttings were taken, when planted out in the open ground, or kept in pots out of doors in summer, will not bear so much cold as the older plants in autumn or middle of winter. Indeed, this is the case with the greater part of plants (heaths as well as others) that I have had an opportunity of trying in this way.

We should, therefore, always prefer old plants to put out when we have the power of choice, before young plants; and when we

have not such choice, we should always protect the young plants with additional covering during winter, beyond what will be necessary for the older ones.

Let any person try the experiment with a broad-leaved myrtle, a plant which most gardeners have it in their power to try; he will find that the old myrtle (if the winter is not very severe) will resist the cold, and, if partially injured, will always set out again in spring from the older wood; but the young myrtle, in a similar situation with the old, will, in most cases, be totally killed the first winter, although the young plant had formerly been taken as a cutting from the older, or raised from seed from the same plant.

In stating the degree of cold which heaths will bear without suffering from it, I have been careful always to keep rather above what I know they will endure; and any person who will take the trouble to observe accurately the cold that heaths will bear, will find that they will not suffer when the thermometer falls a little lower than what I have stated. It would require observations made for a series of years, and a correct statement of the situations and soil in which the different kinds are found at the Cape, to come to any certain conclusion what degree of cold they will bear in this country.

It appears, however, from the short list of habitats which Mr. Bowie has given in the "Gardeners' Magazine," vol. 1, p. 365, when compared with the observations which I have made, that those which are found in pure sand, or in loam, and exposed to drought, are hardier here than those that are found in rocky places, or in shady or moist situations.

From the preceding statement it will appear, as I have already mentioned, that heaths require very little fire heat during winter, probably not more than six or eight nights during our severest winters; the expense of fuel, therefore, can be no object in their cultivation.

I have to apologize for having extended these observations to a much greater length than I at first anticipated; but on revisal I found I could not abridge them without in some degree impairing their usefulness to the inexperienced cultivator of heaths, for whose benefit they are chiefly intended.

Royal Botanic Garden,
Edinburgh, November 8th, 1831.

APPENDIX.

List of Hardy Heaths.

Erica
- arborea
  - stylosa
- australis
  - superba
- carnea
  - præcox
- ciliaris
- cinerea
  - alba
  - atrosanguinea
  - carnea
  - monstrosa
  - rubra
- mediterranea
- minima
- multiflora
- ramulosa
- stricta
- Tetralix

Erica
- alba
- carnea
- umbellata
- vagans
  - alba
  - pallida
  - tenella
- viridipurpurea
- vulgaris (Calluna)
  - alba
  - aurea
  - coccinea
  - decumbens
  - flore-pleno
  - spicata
  - spuria
  - tomentosa
  - variegata

List of the most Ornamental Heaths, which will flower in succession at all times of the year.

	Time of Flowering.		Time of Flowering.
Erica		Erica	
abietina	Sept.-Mar.	Monsoniana	Oct.-May.
acuminata	Mar.-June.	mucronata	Apr.-Aug.
Aitoniana	June-Oct.	mundula	Mar.-July
ampullacea	June-Aug.	mutabilis	all the year.
andromedæflora	Apr.-June.	nigrita	Mar.-Aug.
ardens	Apr.-June.	odorata	Apr.-July.
aristata	May-July.	Parmentierii	June-Aug.
Blandfordiana	Mar.-June.	Patersonia	Mar.-July.
Bonplandia	Apr.-June.	perspicua	May-Aug.
Bowieana	Mar.-Sept.	picta	Mar.-June.
bruniades	Apr.-Aug.	prægnans	May-July.
buccinæformis	May-Aug.	primuloides	May-July.
carneola	May-Aug.	Princeps	Apr.-July.
cerinthoides	Sept.-June.	propendens	May-July.
Cliffordiana	Sept.-Feb.	pubescens	Mar.-Nov.
colorans	Oct.-June.	pyramidalis	Feb.-May.
Coventryana	Mar.-June.	quadriflora	Mar.-Aug.
cubica	Apr.-July.	radiata	May-Aug.
Cussonia	Jan.-Mar.	reflexa	May-Oct.
depressa	June-Aug.	resinosa	Feb.-Aug.
echiiflora	Apr.-June.	retorta	July-Aug.
Ewerana	July-Aug.	Savilea	July-Aug.
elegans	Apr.-July.	scabriuscula	May-July.
erosa	June-Aug.	Sebana	Mar.-June.
expansa	Mar.-July.	Shannonea	July-Sept.
exsurgens	Aug.-Nov.	Solandar	all the year.
fasicularis	Feb.-May.	spuria	May-Aug.
florida	May-Aug.	sulphurea	Mar.-June.
glauca	May-July.	taxifolia	June-Dec.
gracilis	Mar.-June.	Templea	May-Aug.
grandiflora	May-Sept.	Thunbergii	June-Aug.
grandinosa	May-Sept.	togata	June-Aug.
hyacinthoides	June-Aug.	tricolor	June-Sept.
inflata	June-Sept.	tubiflora	Apr.-July.
Irbyana	July-Oct.	tumida	July-Sept.
jasminiflora	July-Sept.	ventricosa	June-Sept.
kalmiflora	Aug.-Feb.	alba	June-Sept.
Lambertia	Aug.-Apr.	carnea	June-Sept.
Linnæana	Jan.-May.	coccinea	June-Sept.
superba	Mar.-May.	erecta	June-Sept.
linnæoides	Nov.-May.	stellifera	June-Sept.
magnifica	June-Nov.	superba	June-Sept.
mammosa	Sept.-Mar.	verticillata	Sept.-Mar.
melastoma	Apr.-July.	vestita-coccinea	Apr.-Nov.
metulæflora	Apr.-Sept.	alba	
		purpurea	

Hardy Cape Heaths.

Heaths which will stand in the open air in autumn or middle of winter without protection, with the thermometer 7 or 8 deg. below freezing, without suffering in any way from such a degree of cold.

Erica
- acuminata
- aggregata
- campanulata
- cerinthoides-superba
- comosa alba
- conferta
- congesta
- corifolia
- cruenta superba
- cupressina
- curviflora
- Ewerana-pilosa
- expansa
- exudans
- ferruginea
- flaccida
- globosa
- glomerata
- gracilis
- grandiflora
- hispidula
- hyacinthoides
- ignescens
- intertexta
- leucanthera

Erica
- longiflora
- longipedunculata
- lucida
- mammosa
- margaritacea
- montana
- nigrita
- pendula
- perlata
- physodes
- pubescens-minor
- ramentacea
- rosea
- serpyllifolia
- setacea
- Sparmannia
- splendens
- tenella
- tenuiflora
- tetragona
- transparens
- triflora
- ventricosa
- viridescens
- verticillata

Tender Cape Heaths.

Heaths which are tenderer than those mentioned in the preceding List, and when exposed to the same degree of cold there stated will be injured by it, but will not suffer although fully exposed to a temperature 4 or 5 deg. below freezing.

Erica
- abietina
- albens
- articularis
- assurgens
- baccans
- barbata
- Blæria
- Bonplandia
- caffra
- calycina
- cerinthoides-alba
- comosa-rubra
- colorans
- concinna
- Coventryana
- cubica-minor
- cyclindrica
- daphniflora
- decora
- depressa
- discolor
- divaricata
- elata
- Ewerana
- gelida
- halicacaba
- incarnata
- Linnæana
  - superba
- linnæoides
- mollissima
- nudiflora
- mundula
- pellucida
- persoluta
- perspicua
- prægnans
- propendens
- pubescens-major
- quadriflora
- radiata
- reflexa-rubra
- rubens
- Sebana
  - aurantiaca
- simpliciflora
- sessiliflora
- spicata
- spuria
- triceps
- trivialis
- tubiflora
- urceolaris
- vestita-rosea
- viscaria

NOTES

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1905-1909.

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On Witches'-Broom of Pyrus japonica.

BY

A. W. BORTHWICK, D.Sc.

With Plates IV. and V.

The peculiar hypertrophy of branches known as "witches'-broom" is not of uncommon occurrence on various members of the Rosaceæ, although the deformation is by no means peculiar to this family, but is to be observed frequently on various other broad-leaved trees and on Coniferæ. As a general rule the buds of the "witches'-broom" unfold in spring in advance of the buds of the normal twigs, but, as Dr. W. G. Smith* points out, the "witches'-broom" of *Alnus* is exceptional—its buds opening after those of the normal twigs.

The figures accompanying this note show a fine "witches'-broom" on a bush of *Pyrus japonica* growing in the Royal Botanic Garden, Edinburgh. Plate IV., fig. *b*, is from a photograph taken in October, 1902, and it shows the "broom" with the leaves still on it, while the rest of the bush is practically leafless. Plate IV., fig. *a*, is from a photograph taken a month later, and shows the "broom" as well as the bush in an almost leafless condition. Unfortunately, gales during the winter broke off the largest part of the "broom," leaving only a small portion still attached, and this is shown in Plate V., fig. *c*, from a photograph taken in February, 1903.

At the date of this photograph the plant had a very good covering of young green leaves and flowers, but the "broom" showed not only no signs of leaves, but no bud-activity whatever,

*W. G. Smith, Untersuchungen d. Anat. u. Morph. der durch Exoasceen verursachten Deformationen. Inaug. Diss., Munich, 1894, p. 16.

[Notes, R.B.G, Edin., No. XVI, 1905.]

although its tissues were still alive. Plate V., fig. *d*, illustrates this—the "broom" is visible in the lower right-hand corner.

The branches of the "broom" of this *Pyrus* are much thicker and more succulent than the normal ones of the plant; they are also of a light yellow-brown colour and covered with a dense felty pubescence contrasting markedly with the thinner dark blackish-brown glabrous normal shoots.

Another interesting abnormality in the "broom" is the entire absence of spines, which are everywhere well developed on the normal shoots of the plant.

As yet no fructifications of a fungus have been detected, but microscopic examination shows abundant mycelium in the tissues.

The "broom" will be kept under observation, and the subsequent history of its vegetative activity, together with any microscopic details which may be of interest, will be recorded in a subsequent paper.

Since the above was written Dr. Solereder has published in the "Naturwissenschaftliche Zeitschrift" for January, 1905, a list of species of trees upon which witches'-broom has been observed. To his list *Pyrus japonica* is an addition, as are also the following species, about which I shall say something in a subsequent note:—*Æsculus Hippocastanum*, *Myrsine africana*, *Quercus Cerris*, *Ribes alpinum*, *Ulmus montana*.

Explanation of the Figures in Plates IV. and V.

FIG. *a*.—Witches'-broom of *Pyrus japonica*. Both abnormal and normal twigs are leafless. From a photograph taken in November 1902.

FIG. *b*.—Witches'-broom of *Pyrus japonica*. The abnormal twigs are still producing young leaves. The normal shoots are almost leafless. From a photograph taken in October 1902.

FIG. *c*.—Witches'-broom of *Pyrus japonica*. The abnormal twigs show no signs of bud-activity. The normal shoots bear numerous young leaves and flower-buds. From a photograph taken in February 1903.

FIG. *d*.—Witches'-broom of *Pyrus japonica*. More of the normal twigs are shown with young leaves and flowers. The abnormal twigs at the lower right corner are leafless. From a photograph taken in February 1903.

Fig. *a*.

Fig. *b*.

Witches'-Broom on Pyrus japonica.

Fig. *c*.

Fig. d.

Witches'-Broom on Pyrus japonica.

On the Effect of Lightning-Stroke on Trees.

BY

A. W. BORTHWICK, D.Sc.

With Plates VI. and VII.

There is a widespread popular belief that certain trees are less liable than others to be struck by lightning, and that during a thunderstorm it is quite safe to stand under a beech, for example, while the danger under a resinous tree or an oak is respectively fifteen and fifty times greater. Scattered throughout literature are many descriptions of the damage done by lightning to single trees and also to groups of trees, but these are confined almost without exception to the external appearance of the lightning-struck tree ; the internal damage caused by lightning has passed without notice.

In the year 1892 Professor Bayley Balfour exhibited and described to the Botanical Society of Edinburgh sections of the stem of a lightning-struck oak (*Quercus Robur*, Linn.), which grew in the woods of Methven Castle, Perthshire. One of the specimens exhibited is shown in Plate VI. If this figure be compared with Plate VII., which shows the damage caused to a tree of *Q. Ilex*, and which will be more specially referred to later on, it will be seen that the damage in both cases is the same.

In the course of the summer of 1896 the late Professor Robert Hartig of Munich* carried out a series of observations on the

* R. Hartig, Untersuchungen über Blitzschläge in Waldbäumen, in Forstl-Naturw. Zeitschr. VI (1897), Hefte 3, 4, 5 ; Id., Neue Beobachtungen uber Blitzbeschadigungen der Waldbäume, in Centralblatt für d. gesammte Forstwesen, August and September, 1899 ; Id., Schädliche Wirkungen des Blitzschlages, Lehrbuch der Pflanzenkrankheiten, 3rd ed., 1900.

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internal effect of lightning on trees. The results were published by him as a first contribution to our knowledge of the subject, the facts being too isolated to allow of his drawing a clear picture of the whole phenomenon, and further exact investigation being required before a satisfactory explanation can be given of the various effects of lightning on the same tree at different times.

Hartig has examined, figured, and described the internal effect of lightning on the following trees:—spruce, silver fir, larch, scots pine, beech, oak, maple, ash.

Almost all of the damage done by lightning to those trees occurred in the living tissue of the bark and in the young immature portion of the youngest annual ring, and it consisted in the destruction of the protoplasm of the tissues. There are several conditions which modify the ultimate effect of lightning on trees, such as the strength of the discharge; the thickness of the bark it has to penetrate; and also whether the bark is wet or dry. Very strong discharges may rive the wood-body of the tree into splinters; while weaker discharges may cause splits or fissures in the wood-body which are not visible from the exterior. If the path is confined to one side, the result is that the sap-wood is more or less splintered, and may be thrown in long strips as far as a hundred yards from the tree. Weaker shocks do not cause very great damage, but produce peculiar and diverse lightning-tracks within or upon the stem, and these have remained undescribed as yet to a great extent.

In order to understand the phenomena properly it is necessary to know, in the first place, the conductivity of different parts of the tree.

Trees with thin bark, for example silver fir, show very peculiar *lightning-tissue*—by which is meant protoplasmic tissue which has been traversed and killed by lightning—in the outer rind. It frequently occurs as small roundish patches, either isolated or connected by zigzag lines, and these patches ultimately become cut off from the living bark by cork-layers.

If the tree has a thick covering of dead bark, then the lightning must force its way through this bad conducting tissue to reach the interior.

A distinction must be made between the conducting power of the several layers of the living bark. The middle and outer

layers, which are poor in fatty material, conduct well ; the innermost (youngest) layer, including the cambium, which is rich in protoplasmic content and contains as a rule much fat, conducts badly. The innermost layer of the living bark is thus protected and may remain untouched, even when the middle and outer layers are partially or completely killed. In very strong discharges the electricity may also pass here and there through the cambium, so that a lightning-wound is made which may be ultimately closed by occlusion, in which case a lightning-track remains visible in the wood-body.

The best conducting tissue in the whole tree appears to be the young wood which is found in the stem from the time of the beginning of vegetative activity in spring until August, and represents the as yet unlignified portion of the year ring. It is very rich in water and contains very little air. The protoplasm lines the cell-walls as a thin layer, and there are only traces of fatty oils present. It has been proved experimentally that this protoplasmic layer is a good conductor, but it may be killed if the current is sufficiently strong. If the lighning-track has been in the young wood the cell-walls remain unlignified, and they are subsequently crushed together by the later formed tissue. In deciduous trees lightning-tissue in the wood is indicated by this collapse of the cells.

The alburnum being rich in water conducts the current better than does the duramen, but not nearly so well as the young wood and bark. At the same time the air-content of the sap-wood and of the splint-wood influences the conductivity of each. The heart-wood of conifers, which contains no liquid water, is the worst conductor of all.

In the Royal Botanic Garden, Edinburgh, an evergreen oak, *Q. Ilex*, stood for many years on the east side of the Palm House. Outwardly it showed very little sign of having been struck by lightning. There were here and there a few short furrows visible on the outside as they are shown upon the photograph (Plate VII.). The tree was so damaged by the gale of November, 1901, when H.M.S. Active was wrecked at Granton, that it was cut down. When the stem was sawn across, several well-marked concentric rings were seen, which proved on subsequent examination to be zones of lightning-tissue (Plate

VII.). The tree had been evidently struck by lightning on several occasions with a lapse of a few years between each stroke.

Along the fissures on the top and left-hand side (Plate VII.) the cambium had been killed in a narrow band and was in process of occlusion. The large split below was caused by subsequent shrinkage in drying, and shows well how the wood has split along a radial line of weakness, where on two separate occasions the cambium had been killed and the injury thereafter occluded. The concentric zones of lightning-tissue consists of parenchyma-cells only, on each side normal wood-elements occur. The cells of the medullary rays seem to undergo no change, but pass uninterrupted through the bands of lightning-parenchyma. There are three complete rings at fairly regular intervals passing from the centre outwards, the last complete ring is, however, in reality double, there being as it were a ring of normal wood bounded on each side by a parenchyma-band, and that is why this ring appears to be broader than the others.

The tree was 61 years old when cut down in 1901. The last complete lightning-zone was formed fourteen years before felling, that is to say when the tree was in its forty-seventh year; the preceding one when the tree was in its forty-sixth year; the third one when the tree was in its thirtieth year; the innermost zone when the tree was in its sixteenth year. Therefore the complete zones of lightning-tissue were formed respectively in 1887, 1886, 1870, 1856. The first time the tree was struck in 1856 the cambium seems to have escaped uninjured, but on the three subsequent occasions the cambium was killed in a very narrow strip always in the same radial line, as is shown by the occlusions. Between the bark and the zone formed in 1887 there may be seen in the Figure what appears to be another complete ring, but it is in reality made up of several parts all of which were formed in 1898, or four years before the tree was cut down. In these later shocks the cambium has suffered in one or two places, as is evidenced by the partially-formed occlusions.

As regards the liability of certain trees to lightning-stroke, Hartig states that no tree is immune, and as a result of his investigations he came to the conclusion that lightning will select one species quite as readily as another. He also found

that the beech was struck quite as frequently as any other species. At the same time he points out that in some places one sees certain species more frequently struck than others, for example, in the Riviera—the eucalyptus; in Germany—the oak and pyramid poplar; and he explains this by the fact that these are the tallest trees in the neighbourhood.

The numerous statistical records have no doubt been collected with the greatest possible care, but Hartig points out how unreliable they must be, as it is very easy to confound the damage done by lightning with that due to other causes and *vice versâ*. In fact, he states that he himself would formerly have recognised a very small percentage of those trees which as a result of his investigations he was able to prove had been struck by lightning.

Lightning usually strikes the under part of the crown, the stem, or the larger branches. The crown remains healthy after the stroke for a time, but dies away subsequently when the stem has become dry. It is seldom that the top or stronger branches are knocked off by lightning.

The root-system does not seem to be ever damaged by lightning, or at most slight traces are left by the current, on some of the stronger side roots.

Only dead or dry parts of the tree can be set on fire by lightning.

Hartig states that he never observed in the whole of his investigations any cells ruptured or torn by the formation of steam as might happen if the heating by the electric current was very great. The cells collapse and shrink up, but are never torn.

The whole phenomenon is a complex one, and notwithstanding Hartig's brilliant work there yet remains a wide field of investigation to be covered before we can satisfactorily explain all the effects of lightning on trees.

Explanation of the Plates VI. and VII.

FIG. 1.—Portion of stem of lightning-struck oak (*Quercus Robur*) from Methven Castle, Perthshire. Seen in transverse section.

FIG. 2.—Portion of stem of lightning-struck oak (*Quercus Ilex*) from the Royal Botanic Garden, Edinburgh. Seen in transverse section.

Lightning-struck Quercus Robur, from Methven Castle, Perthshire.

Transverse section of Quercus Ilex. L., photographed in dry condition, showing numerous lightning marks, also old and recent occlusions of lightning wounds.

On the Activity of the Glands of Byblis gigantea, Lindl.

BY

A. NINIAN BRUCE, B.Sc.

Plants of *Byblis gigantea* grown in a plant-house of the Royal Botanic Garden, Edinburgh, at a temperature of between 50° and 60° C. were the subject of the following experiments which were carried out in the plant-house.

A large plant of *Byblis gigantea* was placed on the same stand as several plants of *Drosera* (of various species) and *Drosophyllum lusitanicum*. While the plants of these genera had caught respectively an almost equal number of flies, in no case large, there being only, in the case of *Drosophyllum lusitanicum*, five or six flies on a leaf about 15 cm. long, the plant of *Byblis gigantea* was smothered with flies, although it was smaller than the adjacent plant of *Drosophyllum lusitanicum*. On a single leaf of a plant of *Byblis gigantea* about 17 cm. long, I once counted remains of thirty-one flies. On young vigorously growing plants, where the leaves were only about 2·5 cm. long, I repeatedly counted from eight to twelve flies; and, on a small plant, the main stem of which was about 12 cm. long, and on which all the stalked glands were actively secreting, I counted remains of fifty-six flies. This shows what a very strong attraction the secretion from the stalked glands of *Byblis gigantea* has for flies, an attraction which seems to be greater than that in the secretion from the tentacles of *Drosera* and other members of the Droseraceæ hitherto described.

The glands of *Byblis gigantea*, which have been fully

described by F. X. Lang,* are of two kinds: sessile glands arranged more or less in rows, and stalked glands, which are not so numerous as the sessile ones. The heads of the stalked glands are surrounded by a glistening drop of secretion, which is always absent from the sessile glands. Their secretion is neutral to litmus paper. In no case did I find an acid reaction. In being neutral it agrees with the secretion from the tentacles of *Drosera*, but differs from that of *Drosophyllum lusitanicum*, which is strongly acid. The head of the stalked glands does not contain any purple fluid. Darwin mentions as the outcome of his examination of dried specimens that "the glands of Byblis are purplish"; this I did not find to be the case in the living plant of *Byblis gigantea*.

Experiment I.

In order to determine if the tentacles possess the power of movement, I examined many tentacles to which insects were adhering, but was quite unable to discover any signs of inflection; nor was any sign of movement to be detected on irritating the tentacles with a needle nor on scratching or pricking the blades. This is what might have been expected, since the pedicel of the stalked glands is unicellular, and, according to Sachs, "no instance is known of any unicellular structure possessing the power of motion."

Experiment II.

A small cube of albumen about 1 mm. in size was placed on the sessile glands, and after 48 hours was completely surrounded by an acid secretion. On examining the cube with a lens, it was seen that the edges and corners had been rounded off. After three days, the cube was represented by a small round white spot in the centre of a drop of secretion. At the close of the fourth day, this white spot had become smaller, and next day had completely disappeared.

*F. X. Lang, Untersuchungen über Morphologie, Anatomie, und Samenentwicklung von *Polypompholyx* und *Byblis gigantea*, in Flora, lxxxviii(1901).

Experiment III.

A cube of albumen (about 2·5 mm. in length), slightly larger than that used in Experiment II., was placed on the sessile glands. After twenty-four hours a little secretion had been poured out, which after forty-eight hours was very much increased. On examining the cube at the end of the fourth day, it was found that the lower edges and corners had been rounded off. After six days the cube had sunk down on to the surface of the leaf, and the upper edges and angles were rounded off. Two days later the cube had become more or less round. At the close of the eleventh day the remains of the cube were found lying on the surface of the leaf quite dry, the whole of the secretion having been absorbed.

Experiment IV.

A small cube of albumen just under 1 mm. in size, which had just been removed from an egg, and thus was moist, was placed on the sessile glands, and after two days had been completely dissolved.

Experiment V.

A cube of albumen of a little over 1 mm. in size was cut from the top of an egg which had been kept for about two days. This cube was carefully dried so as to remove all traces of moisture and was then placed on the sessile glands so that it did not come into contact with the secretion from the stalked glands. This cube was examined at the end of the first, second, third, fourth, and fifth days, and after this time, examination with a lens showed that the edges and angles had not been rounded off, and it was not surrounded by a drop of secretion.

Experiment VI.

Small fragments of broken glass were placed on the sessile glands which were observed every day for a week; by the end of the period no secretion had been poured out.

Experiment VII.

A drop of a dilute solution of carbonate of ammonia was placed on the sessile glands, which after twenty-four hours became darkened, owing to the salt having been absorbed. On looking at the glands several days afterwards they had quite lost their black colour, showing that they had not been killed.

These experiments show that the sessile glands of *Byblis gigantea* possess the power of digestion. This power, however, seems to be limited, since if the piece of albumen is too large, it is not all digested. This might, however, be due to the white of egg absorbing so much of the moisture into itself, that the glands are injured and unable to continue resecreting.* The secretion from the sessile glands differs from that of the stalked glands in being acid to litmus. The sessile glands do not secrete spontaneously, a fact which is shown since particles of glass did not bring forth any secretion, neither did a perfectly dry piece of albumen. If, however, the albumen is moist and contains a little soluble nitrogenous matter, this causes the glands to pour forth immediately their secretion, which is acid, and is able to digest animal substances. The soluble nitrogenous matter which is required to cause the glands to secrete probably enters the gland by osmosis through the cell-wall, since if the albumen is fresh, the secretion is poured forth quickly, and the cube of albumen is rapidly dissolved. If the cube is not quite so fresh, it will have dried up to a certain extent, and there will not be so much soluble nitrogenous matter, so that the osmosis will not take place quite so quickly, the glands will take longer to be stimulated, and will, in consequence, not pour out their secretion so quickly, and this is exactly what I found to be the case. If, on the other hand, the albumen is completely dried there will be no nitrogenous material present in solution, the glands will not be stimulated, and no secretion will be poured out.

After the secretion has digested the animal remains, the dissolved matter is absorbed by the glands, as is shown by their

* Compare the effect described later of placing too large pieces on the stalked glands.

becoming dry, and by the aggregation of their protoplasmic contents with carbonate of ammonia. The sessile glands do not contain any red colouring matter.

Experiment VIII.

Experiments upon the secretion of stalked glands are much more difficult to carry out successfully on *Byblis gigantea* than on *Drosophyllum lusitanicum*, owing to the drop of secretion from the stalked glands of *Byblis gigantea* being much smaller; and further, as the glands are not very close to each other, it is not easy to place a small cube of albumen so as to rest on several of them at the same time.

A small cube of albumen was placed on one of the stalked glands, which was examined twenty-four hours later. The cube was then found lying on the gland, and not surrounded by secretion. This was due to the fact that the albumen had absorbed the moisture of the drop, which thus became quite dry, and as it did not resecrete so long as the cube was lying on it, the gland was probably slightly injured.

Experiment IX.

A small cube of albumen, about half the size of that used in Experiment VIII., was placed on one of the stalked glands, and, after twenty-four hours, the secretion was not absorbed. At the end of two days the cube had become transparent, but there were no signs of any rounding off of the edges or angles. After four days it was still surrounded by secretion, and, as it was not digested by the end of the fifth day, I removed it and placed it on the sessile glands below. which quickly poured forth their acid secretion and completely digested it.

This experiment shows that the secretion from the stalked glands has not the power of digestion.

When an insect alights on one of the leaves, it first comes in contact with the drops of secretion on the heads of the stalked glands (which continually secrete). It is held by the secretion of these glands. In its efforts to escape, however, it moves across the leaf, and thus comes in contact with the secretion from neighbouring glands. It ultimately becomes so surrounded by the secretion that it is suffocated, and falls down helpless on to the sessile glands below, which after a short time pour forth their secretion, and after digestion of the remains, the soluble matter is absorbed.

I saw flies caught by the plant in this way. The secretion from the stalked glands is in the form of round drops, which are easily removed on touching the gland with a needle, and are so viscid that they may be drawn out into thin threads many centimeters long.

The above record of experiments upon the activities of the glands of *Byblis gigantea* discloses a parallel with the activity of the glands of *Drosophyllum lusitanicum*. In *Drosophyllum* the glands are of two kinds, stalked and sessile; the sessile glands do not secrete unless stimulated, when they pour out their digestive secretion and afterwards absorb the digested matter. The stalked glands continually secrete, are not digestive, and are chiefly useful to the plant for catching insects. But whilst there is this functional parallel the construction of the gland is different in the two plants.

It seems to me to be probable that the sessile glands of *Drosophyllum lusitanicum* have been derived from the stalked glands by the loss of the pedicel; while in the case of *Byblis gigantea*, it is possible that the opposite is the case, namely, the stalked glands have been derived from the sessile ones, since the pedicel is unicellular, and might be considered to have arisen by the elongation of the single cell which corresponds to it in the sessile glands.

The Production of Adventitious Roots and their Relation to Bird's-Eye Formation (Maser-Holz) in the Wood of Various Trees.

By

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With Plates VIII.-XI.

In the spring of 1903 my attention was called by the Regius Keeper to the fact that many cherry-laurel shrubs (*Prunus Laurocerasus*, Linn.) in the Royal Botanic Garden, Edinburgh, as well as elsewhere, were prone to produce an abundance of adventitious roots, and under his direction I began an examination of the phenomenon with the object of determining what conditions brought about their formation.

While searching in the Garden for material showing roots in various stages of development I came across three young maple trees, each of which had produced numerous adventitious outgrowths somewhat resembling those on the cherry-laurel, and subsequently the Regius Keeper showed me two young apple trees which were literally covered with outgrowths of a similar nature. After that I commenced a systematic search throughout the Garden in the hope of discovering other examples, with the result that similar formations were found on several specimens of wych-elm, Lawson's cypress, and *Thuja gigantea*.

A few microscopical sections soon confirmed the original impression that those adventitious structures were in reality roots. They could be traced back as round cylindrical prolonga-

tions through several year-rings of the wood until they ultimately merged into normal medullary rays, from which, as subsequent investigation proved, they took their origin ; and although differing in some minor details, the adventitious roots in the different species to be described in this paper agree in one important point, that is, they all originate from medullary rays, which, by a process of cell-division, have become abnormally broad, so that they appear like cylinders running through the wood and phloem, whence by a process of apical growth they are continued out as root-rudiments into the cortex, through which these ultimately force their way to the exterior. Their increase, especially in the tangential direction, causes the elements of the xylem and phloem to assume a bent and twisted or wavy course, such as is found in the so-called Curled or Bird's-eye Maple.

A search through the literature indicated that the subject would repay further investigation, hence a detailed examination of each specimen was undertaken. My results, so far as they have gone, are in entire accordance with, and confirm those of, previous authors, but they will be allowed to speak for themselves. Before proceeding, however, to the detailed description of the species examined, a brief resumé of some of the more recent literature on the subject is given. I may mention that it has been my special endeavour to confirm the statements made in this paper by means of photographs.

According to Strasburger[1], Curled or Bird's-eye Maple owes its origin to "the unusually sinuous course taken by the elements of the wood," which he attributes to the production of numerous adventitious buds, and also to the formation of abnormally broad medullary rays round which the wood elements are forced to bend, and thus to deviate from their usual course. No mention is made of these rays being rhizogenous.

Frank[2] points out that bird's-eye formation in wood is not due to adventitious buds alone. He finds that medullary rays may become round and enlarged, thus displacing the elements of the xylem and phloem, so that they must assume the characteristic wavy irregular course seen in this kind of wood. He further states that recent authors are fairly unanimous in the view that

[1]Strasburger, Text-book of Botany, 2nd Eng. Ed., 1903, p. 143.
[2]Frank, Die Krankheiten der Pflanzen, 2nd Ed., Vol. I (1895), p. 81.

bird's-eye formation in wood is directly caused by the presence of numerous adventitious buds, and that bird's-eye maple occurs principally where such buds have been formed in numbers, especially such as result from wounding. These buds are developed from small groups of meristematic cells produced by the cambium. Some develop into short-lived shoots, others persist as small woody cones. In either case they form cylindrical interruptions in the cambium, and the newly-formed elements of the wood and bast are forced to deviate from their usual course and form the characteristic convolutions round these centres or "eyes," which can be always recognised in the net-work formed by the vasa.

The late Professor R. Hartig[1] also proved that not only adventitious buds but also remaining pieces of old tissues, when they occur at a place over which callus is being formed, can offer the same local hindrance to the course of the newly-formed wood-elements, so that they become surrounded and isolated like islands in the callus. He observed in occlusions where the wood-body was covered with old bark still adhering to it by means of the medullary rays and remains of cortical tissue that the grain of the wood was interrupted by those remains, the newly-formed elements being forced to deviate round them.

In anatomical structure the burred wood agrees in all essential points with normal wood, and Frank definitely states that it may be produced by a broadening of certain medullary rays without any accompanying adventitious buds or other foreign bodies, and he points out that, among former authors, Schacht alone mentions that burred wood can occur without any accompanying adventitious buds, and that the same author found very beautiful bird's-eye formation on the outer year-rings of smooth stems of specimens of *Abies* and *Castanea* which were several hundred years old.

A curious case of burr-formation in the apple is mentioned by Sorauer[2], who describes and figures certain groups of conical outgrowths, which may arise either on one side or all round the stem. Those groups occur principally at the base of the shoot

[1] Hartig, Zersetzungserscheinungen des Holzes (1878), p. 136. Taf. XIX. Figs. 5 to 8.

[2] Sorauer, Schutz der Obstbaume (1900), p. 139.

or at the junction of a new shoot with that of the former year, but seldom in the middle of the shoot. He ascribes their origin to a growth-peculiarity in some trees in which the medullary rays have been unusually broad from the first, or become broad later, and project as wedge-shaped protrusions into the cortex which is ruptured. He states "that the majority of these projecting "medullary rays are covered by a woody-cone which is in "continuity with the last year-ring of the branch. Neither buds "nor leaf-rudiments can be recognised on these new formations, "so that they are to be regarded as wood-pegs, and the phenome-"non is to be explained as 'Kropfmaserbildungen.'"

There is a strong resemblance between the *Pyrus* described by Sorauer and the one to be described in this paper. They seem indeed to be identical if one compares the illustrations and descriptions, although Sorauer's interpretation differs from mine.

The formation of adventitious roots on the stem is not uncommon in willows and poplars, but in most cases some damage to the main root-system has preceded their production.

According to Frank[1], when the main root-system suffers injury, by any cause whatever (fungus, insects, physical conditions of soil), there occurs a production of new adventitious roots above the injured part, especially on the normally subterranean stem-portion of the perennating plants, but even also on the under part of the stem near the surface of the soil.

Further, according to R. Hartig[2], when the free access of air to the roots is prevented by too deep planting, the roots are killed. The tree either dies straight off, or may die off gradually, without being able to form new roots or replace the asphyxiated ones. Only a few trees, for example, willows, poplars, but more frequently shrubs, can develop numerous adventitious roots near the surface of the soil, and, like rootless slips, may form a new root-system. Similar conditions occur where earth is piled up round old trees, as often happens by the sides of roads and railway cuttings.

That the willow can produce numerous adventitious roots even on fairly thick-barked trees may be seen in Plate VIII., Fig. 1.

[1] Frank, Die Krankheiten der Pflanzen, 2nd Ed., Vol. I (1895), p. 91.
[2] R. Hartig, Lehrbuch der Pflanzenkrankheiten, 3rd Ed., (1900), p. 265.

This tree stands near the pond in the Royal Botanic Garden. Its rate of growth has been carefully recorded by Dr. Christison[1]. It is in a well-sheltered position and grows in fairly damp soil. Incidentally, it may be mentioned that in this specimen many of the earth-roots were projecting with their free ends above the ground. Directly they reached the soil-surface they became thick and fleshy, with a deep red colour, very much resembling, in fact, the adventitious roots produced on the stem. They could be followed down in an oblique direction into the soil, in which they branched copiously till they joined the main system.

Following that of the willow is a figure (Plate VIII., Fig. 2) of a gean-tree (*Prunus avium*) situated on the western border of the Garden, at the base of which an abundant production of adventitious roots has taken place. The tree is in a fairly sheltered situation and appears to have been severely pruned some years ago. On a recent botanical excursion Professor Bayley Balfour called my attention to a similar tree on which he found, in addition to the basal adventitious roots, dense patches of such structures (see Plate VIII., Fig. 3) formed on the stem up to a height of from five to eight feet above the ground.

A paper, accompanied by a plate containing eight figures, by H. Klebahn[2], "Ueber Wurzelanlagen unter Lenticellen bei Herminiera Elaphroxylon und Solanum Dulcamara," and another paper by Terras[3], accompanied by six figures, "On the Relation between the Lenticels and Adventitious Roots of Solanum Dulcamara," give interesting accounts of the production of adventitious roots in those species.

Many points of resemblance are to be found between the figures accompanying those articles and the figures which accompany this one, although they do not agree in all details. For example, Klebahn does not find a connection between the adventitious roots and the medullary rays, while Terras finds that in *Solanum Dulcamara* the phellogen is stimulated to active division in front of the protruding root-rudiment. This species, therefore, seems to differ from those examined by me; since in

[1]Christison, in Notes from the Royal Botanic Garden, Edinburgh, No. 3, Dec. 1900, p. 60.

[2]Klebahn, in Flora, Vol. LXXIV (1891), p. 125.

[3]Terras, in Trans. Bot. Soc., Edinburgh, Vol. XXI (1900), p. 341.

few cases did the phellogen show any unusual activity. Again, in all cases I found a connection between the cambium of the stem and that of the root—a fact which is not figured or mentioned by the above authors in the species examined by them.

Geyler[1] has shown that the production of aerial roots is a common occurrence on *Laurus canariensis*. Their time of vegetation lasts from the end of autumn to the beginning of summer in the following year, when they turn blackish, dry up, and fall off. They occur at varying heights on the stem and are especially abundant near branch-wounds, around which they occur in circles. They seem to occur more abundantly in moist, shady gullies where many laurel-trees are thickly crowded together, while they are not to be found on single standing or isolated trees. The author ascribes their formation to the action of a parasitic fungus, and it would seem that here the production of aerial roots is purely pathological.

Lawson's Cypress and Thuja gigantea.

There are many specimens of *Cupressus Lawsoniana* and *Thuja gigantea* in the Royal Botanic Garden which show numerous papilla-like projections standing out at right angles to the shoot-axis. These are frequently of a bright green colour and vary in shape from that of a cone to that of a sphere. They seldom exceed 3mm. in length or diameter; they may occur all over the shoot, on the leafy twigs as well as on older shoots from which the leaves have fallen. Externally they appear merely as raised portions of the periderm and are irregularly distributed all over the shoot-axis (Plate VIII., Fig. 12).

If a section is made so as to pass either in a transverse or in a radial longitudinal direction through the stem-axis, the protuberance is seen to be in organic connection with the wood-body of the mother-stem. Such sections are shown in Plate VIII., Figs. 4 and 5, in both of which it is clear that the wood-cambium of the stem passes into the outgrowth and further, that in the outgrowth two distinct regions may be recognised—a central axile portion and a peripheral cortical one. It will also be seen that the cortex of the stem takes no part in the formation of the papilla, but that it is merely passively stretched.

[1] H. Th. Geyler, in Bot. Zeit., Vol. XXXII (1874), p. 322.

The origin, method of growth, and morphology of those structures is illustrated by the accompanying series of figures.

The first changes, which ultimately lead to the formation of those outgrowths, are found to take place in a medullary ray, the cells of which become very rich in protoplasm and develop large conspicuous nuclei. They then begin to divide by radial walls, so that the ray gradually increases in breadth till it ultimately loses its flattened plate-like character and becomes more like a cylinder in shape.

Plate VIII., Fig. 7, shows a ray in which this process had begun two or three years previously. It appears as an attenuated wedge with the thin end towards the pith, becoming gradually broader on its outward course through the xylem and dilating in the extra-xylar and cortical portion of the stem in a club-like manner. Throughout its whole length it consists entirely of parenchyma-cells. Those of the swollen apex are in an active state of division and growth, and are readily distinguished from the cells of the surrounding phloem and cortex by their large well-marked nuclei.

A further stage of development is shown in Plate VIII., Fig. 8. Here may be seen curving into the ray the cells of the wood-cambium which proceed to lay down, in a centrifugal manner, tracheids, the long axis of which is in a plane more or less at right angles to that of the wood-body. The first trace of this in-arching of the cambium may be seen in Plate VIII., Fig. 7, to the right of the ray where it passes through the cambium-zone. From this stage onwards the central portion of the ray consists of parenchyma plus tracheids.

In Plate VIII., Fig. 6—an older papilla in transverse section—the parenchyma-cone has become much larger, the central cylinder which is in connection with the wood-body of the stem makes a downward curve towards its apex—see Plate VIII., Fig. 5—hence this portion is not included in the section, but the preparation serves to illustrate how the parenchyma-cone has developed and has almost totally obliterated the cortical cells lying in its line of growth. It also indicates that the phellogen does not take any part in the formation of the protuberance. Whether the phloem-parenchyma participates in its formation or not I cannot say, but from an examination of all my sections I am strongly inclined to

believe that this parenchyma-cone is derived by growth from the medullary ray, and that it is an exaggeration of the rudimentary cone seen in Plate VIII., Fig. 7.

The section (Plate VIII., Fig. 11.) is transverse to the medullary ray as it passes through the wood-body, and being tangential to the stem near the periphery of the wood the centre is occupied by xylem, and to the right and left of this occurs a narrow strip of phloem cut obliquely. In the wood-body the medullary ray appears circular in outline. The figure also illustrates how the tracheids of the wood have become curved and twisted on their passage into the medullary ray. Those tracheids, which lie immediately above and below the ray, do not reveal any twisting in the section, but that they do bend into the ray is apparent in Plate VIII., Fig. 5; as they are curved, however, in the median plane we merely see them cut at various angles, more or less oblique. On the other hand, the lateral tracheids, or those lying to the right and left of the ray, show distinctly this incurving and torsion, which we would expect to find after an examinatinon of Plate VIII., Fig. 8. The passage of the ray was traced through the phloem, whose elements were found to twist the curve into the ray, much in the same manner as those of the xylem. The bending aside or lateral displacement of the bast-fibres and the radial arrangement of the xylem in the developing root was very conspicuous in this region. A section made in the cortex of the stem and therefore nearer the apex of the papilla shows a surrounding sheath of parenchyma which belongs to the cone seen in Plate VIII., Fig. 6. Near the apex of the papilla an outer ring of tissue belonging to the cortex of the parent axis becomes visible, but it is very narrow, and its cells, which abut on the parenchyma-cone of the medullary ray-root, are very much compressed, and the apical meristem of the root occupies the greater part of the section.

Plate VIII., Fig. 13, illustrates the appearance of a similar outgrowth formed on *Thuja gigantea*. The section is transverse to the mother-axis and therefore longitudinal to the papilla which is cut in median section. At its apex is seen an undifferentiated mass of meristematic cells in which no trace of the central axis-cylinder can as yet be detected. Further down, the central cylinder appears and its basal connection with the xylem,

cambium, and phloem of the stem is quite evident. A series of transverse sections showed that those papillæ were undoubtedly the beginnings of adventitious roots which spring from rhizogenous medullary rays. Their passage through the wood and bast presents the same features as those already seen in Lawson's cypress. In the wood-portion the characteristic incurving of the tracheids was very marked. The cortical cells to the side of the protruding cone (see Plate VIII., Fig. 13) are stretched and elongated, while those in front are crushed and flattened. There is also a striking difference between the size of the cells in cone and cortex. The appearance of a transverse section through the middle of one of these adventitious roots of *Thuja gigantea* is shown in Plate VIII., Fig. 10. The axile portion is surrounded by an endodermis outside of which lies the relatively broad cortex. The vascular bundle is tetrarch, being composed of four patches of primary xylem between which are placed the phloem-bundles. An enlarged view of the central portion of this root may be seen in Plate VIII., Fig. 9, where the structure can be made out better. A section through the tip of this root merely showed an undifferentiated mass of small-celled parenchyma-tissue.

Maple.

Three young maple-trees growing in the Botanic Garden exhibit a similar phenomenon. They occur in the midst of a clump of other trees and shrubs of various kinds. The soil in which they grow is well supplied with water, and the shade and shelter afforded by the other trees keep the lower portion of their trunks fairly moist. Their ages, as ascertained by Pressler's increment-borer, vary from 12 to 15 years. The only one which was sufficiently isolated to photograph is shown in Plate IX., Fig. 14. This photograph was taken about the beginning of April. The foliage-buds were then well advanced, and a fortnight later the lower part of the tree was covered with leaves, which, however, subsequently suffered severely from late frost. Plate IX., Fig. 15, is a nearer view of the limb of this tree to the right, just where it makes a bend to the left, and on it may be seen an abundant development of conical protuberances.

Plate IX., Figs. 16 and 17, are portions of the other two trees,

while Plate IX., Figs. 18 and 19, are nearer views of parts of Plate IX., Fig. 17. It will be seen from the figures that the protuberances occur irregularly distributed over the surface of the stem and have no definite sequence of development and also that they may occur singly or in dense clusters. Many of the outgrowths on the trees shown in Plate IX., Figs. 14 and 17, have pierced the periderm and protrude as short, white cylinders; whereas, on the specimen in Plate IX., Fig. 16, the periderm has merely been raised into papillæ but has not yet been pierced. Those endogenetic structures do not necessarily make their appearance externally, even as minute papillæ on the periderm, till some time after their formation. When visible from the outside they can be traced back through two or three or more year-rings of the wood. In fact a tangential longitudinal section of the stem at one of those root-clusters shows all the appearance of the so-called Bird's-eye Maple. In Plate IX., Fig. 19, the lower part of a root-cluster has been cut away in order to show this feature.

The specimens shown in Plate IX., Figs. 20, 21, and 22, are instructive and illustrate several important features. The top specimen in Plate IX., Fig. 21, is a short cylinder extracted by means of Pressler's increment-borer, and has one of these conical projections at its apex. The lower specimen of the same figure proves that the core of the cone is in organic connection with the wood-body of the stem, the cap-like covering of the bark having been lifted off. An enlargement of this specimen is given in Plate IX., Fig. 22, in order to show that the woody-cone does not terminate in a single point, but runs out into several fine threads. In the cap-like portion at the top of this figure the outer cork layers are seen to have been ruptured by the emergence of a whitish cylindrical protrusion. The bottom specimen of Plate IX., Fig. 20, is a cylinder split longitudinally. The darker central band is the basal continuation of the protuberance through the wood-body of the stem. The middle specimen is a cylinder in transverse section and shows two such round swollen rhizogenous medullary rays on their passage through the wood; while at the top of the same figure is a part cut out of a stem with scarcely any apical papilla, although a dark streak may be detected running in towards the pith. This is the commencement of one of these outgrowths. Plate IX., Fig. 25, shows, greatly enlarged,

a longitudinal section from the surface of the bottom specimen of Plate IX., Fig. 20. It consists of three photomicrographs of different portions taken separately and subsequently pieced together. The inward prolongation of the papilla is distinctly seen passing through the cambium and wood. It will be observed that here again the cambium-cells show the same incurving as do those of Lawson's cypress and *Thuja gigantea*. The apex of the papilla appears hollow and torn. This is due to the resistance offered to its outward growth by one of the bundles of hard sclerenchyma-fibres which occur in the cortex. To the left in the cortex lie a few dark discoloured patches of sclerenchyma which have been displaced by the outgrowth. They have, however, offered a certain resistance which is indicated by the depression formed opposite to them in the protruding cone.

Plate IX., Fig. 24, represents an early stage in the development of a papilla, which, although continued for some distance back through the wood, is not yet visible on the outside. The formation of the papilla commences with the broadening out of a medullary ray round the end of which the wood-cambium spreads. Simultaneously with this a conical cap of parenchyma is formed over the apex, which projects into the cortex of the stem. This parenchyma-mass seems to arise from division of the parenchyma-cells of the phloem. It may be seen in the figure arching out into the cortex and compressing its cells, so that the gradual attenuation of the cortex in front of this developing cone is quite apparent. The line of demarcation between the two tissues is indicated by the dark line of crushed cells. In the middle of the papilla occurs a triangular area consisting of a disorganised mass surrounded by one or two layers of meristematic parenchyma. The central mass is composed of somewhat displaced and crushed-up remains of sclerenchyma-fibres.

A further stage of development is shown in Plate IX., Fig. 23. The parenchyma-cone has now become much larger and has reached the outer cork-layer through which it is about to break. Right and left lie the sclerenchyma-fibres and other tissues of

[1]Sorauer, Schutz der Obstbaume (1900), p. 58, finds that meristematic cells may arise in a similar way round hard sclerenchyma-bundles in the cortex of the apple-tree.

the cortex which have been pushed aside and displaced. The line of displaced sclerenchyma-fibres on the right and the white streak formed by splitting to the left indicate approximately where the protruding parenchyma-cone abuts on the cortex. At its apex is seen a patch of disorganised tissue which is again caused by sclerenchyma. The prolongation of the wood-cambium around the protruding medullary ray is very clearly seen. This cambium-mantle lays down tissue on both sides. The cells deposited on the inside become thick-walled and lignified, while the tissue on the outside retains its parenchymatic character and appears as a light-coloured zone.

A transverse section near the apex of a mature outgrowth shows a central and a cortical mass of tissue surrounded by a peripheral layer of cork. In sections taken lower down it is quite easy to make out endodermis, pericycle, phloem, xylem, and pith. The arrangement of the vascular elements is that characteristic of roots as may be seen in Plate X., Fig. 30, which illustrates the appearance of a transverse section taken through the base of the protruding portion of a root. In it the first traces of xylem may be distinguished, between which lie the three patches of phloem rendered conspicuous by the large white cells which one usually finds associated with the phloem in maples. The pith runs out into three arms, at the ends of which occur the xylem-patches. Outside the pericycle and endodermis comes a relatively broad cortex with its outer layer of cork-cells. Plate X., Fig. 28, shows a transverse section through the basal portion of an older and more mature root. The pith has become thick-walled and sclerosed. The three patches of xylem have become more elongated and the phloem is more pronounced. In other cases, not figured here, however, secondary growth in thickness was found to have taken place. In Plate X., Fig. 28, the outer cork-layer is also more marked than in Plate X., Fig. 30. Although the figures given here show tetrarch construction, diarch and triarch bundles were of quite as frequent occurrence.

A longitudinal section of a mature medullary ray-root with its central cylinder, cortex, and outer cork-layers is shown in Plate X., Fig. 26, but the features of interest to be noted here are the two lenticular patches placed right and left at the base of the

protruding root. In Plate X., Fig. 27, we have one of those patches more highly magnified, and in it may be distinctly seen a connection between the cork-cambium of the stem and the cork-cambium of the root. The piece of cork-cambium seen on the left-hand side of the figure belongs to the stem. At the base of the lenticular patch this cork-cambium forks, one branch running round the outside, while the other branch passes round the inside of the patch at the top of which the branches unite and continue round the periphery of the medullary ray-root. This lenticular patch of tissue is a portion of the parenchyma-cone seen in Plate IX., Figs. 23 and 24, which has ultimately been pierced through by the outgrowing root.

These roots are not permanent structures, but die off at a comparatively early period after they have pierced the periderm, but before this happens a cork-layer is formed across their bases by a branch from the cork-cambium of the stem given off shortly before it forks around the lenticular patch of tissue referred to above. This cork-cambium may be distinctly seen in Plate X., Fig. 29. The old root is cut off therefore much in the same way as a leaf. Sorauer gives a figure[1] of a portion of stem of maple on which bird's-eye wood (Maser-holz) has been formed. The bark has been removed to show what the author calls the wooden-pegs (Holz-Spiese). At the top of the figure they are shown in cross section. The structure presented in that figure recalls very strongly what is seen in our Plate IX., Fig. 19, while the projecting woody-cones resemble the one seen in Plate IX., Fig. 22. Whatever other causes may produce Bird's-eye Maple it would certainly seem that lignified rhizogenous medullary rays can bring about its formation.

Apple.

A very curious and striking example of an abundant production of adventitious outgrowths was pointed out to me by the Regius Keeper on two small apple-trees in the Royal Botanic Garden. All their stems and branches were covered by remarkable coral-like excrescences, especially noticeable at the base of both spur-shoots and elongated shoots. Plate X., Fig. 31, gives the

[1] Sorauer, Pflanzenkrankheiten, 2nd Ed., Vol., I (1886), p. 732, Fig. 38.

general impression presented by a portion of one of those trees In Plate X., Fig. 37, we have a detached branch with its spur-shoots ; at the base of each spur-shoot a number of those conical projections may be seen, while at the base of the branch itself their massed arrangement is very apparent. Plate X., Fig. 36, is the basal portion of Plate X., Fig. 37, enlarged.

It may be well to mention here that these outgrowths were evidently in no case the result of previous wounds and had not been preceded by any callus formation.

In order to see how they would behave when brought into heat and moisture, a cutting was taken from one of the trees and placed in a forcing frame of a warm moist glass-house. The conical protuberances in a surprisingly short time (36 hours) had elongated about 6mm. and in two days were 13mm. in length. This specimen is shown in Plate X., Fig. 35. When put into moisture and heat the protuberances were in the same condition as those seen in Plate X., Fig. 37. It will be observed that in their growth the roots have a downward tendency. This is well seen in Plate X., Fig. 34, which is a photograph of a cutting laid horizontally on the fibre of the forcing frame in the hot-house. The roots then grew vertically downwards into the fibre. Moisture, as might be expected, has a great effect on the rate and direction of their growth.

Plate XI., Figs. 39, 40, and 41, illustrate the effect of causing one of the roots to grow into a glass tube filled with sand. Fig. 39 shows the cutting before the tube was attached. Fig. 41 indicates how the tube was attached ; the root is seen growing into it ; while in Fig. 40 we have the root after the tube was removed. That those structures have a strong geotropic tendency is clearly shown in Plate X., Figs. 32 and 33. A cutting was inverted so that its apex pointed in a downward direction ; when the roots developed, their direction of growth was towards the turned-down apex, Plate X., Fig. 33. After being allowed to remain in this position till the roots were about 6mm., the cutting was re-inverted, so that base and apex each occupied its normal relative position ; this was immediately followed by a downward curving of the root-tips (Plate X., Fig. 32.)

When the air-moisture was sufficiently great, a fine felty covering of white silvery hairs was developed. The sand-

particles adhering to the root in Plate XI., Fig. 40 are held there by those hairs. The behaviour of the roots when grown in water agreed exactly with what might have been expected, that is, they became very much elongated, with no vestige of root-hairs and assumed the white colour typical of water-roots. Two or three roots of a cutting were kept just above the level of the water, with the result that they did not undergo the same change in character as those which were submerged.

THE STEM.—In a radial longitudinal section which has passed through a bud of the young stem the centre is occupied by a relatively broad pith, bounded on either side by a narrow white strip of young wood, from which the leaf-trace-bundles may be seen to come off and to pass upwards in an oblique direction through the cortex each on its way to a leaf. If, after a leaf has fallen, the scar left be examined, three dark dots may be seen on its surface, which indicate that three leaf-trace-bundles enter the petole; although only one is seen in a longitudinal section.

The vascular system of the axillary bud is also seen to come off from that of the mother-axis, but at a much higher level than the leaf-trace-bundles.

The sequence in which those various branches come off from the main system may readily be made out in transverse sections. In a section which passes across the main axis just at the place where the leaf-traces come off we have three outstanding bundles —a large central one and two smaller laterals which are about to pass through the cortex on their way out to a leaf-base. A section taken a little higher up shows that the lateral leaf-traces pass quicker into the cortex and become free sooner than the central one. In a section taken still higher up, and which passes through the base of the leaf-cushion, all three traces have become quite independent strands. The vascular system of the bud comes off here, interior to but in the same radial plane as the central leaf-trace. The cambium ring of the stem passes in a loop-like manner round its periphery, and the pith is also continued out into it. This semi-circular portion of cambium proceeds to lay down xylem on the inside and phloem on the outside. Further up, when the vascular-system of the bud with its central pith becomes entirely free, this cambium forms a complete ring. This arrangement of the leaf-trace and bud-

bundles was carefully studied in the specimens in order to make quite sure that there should be no chance of mistaking any of these several bundles for those of the adventitious roots.

THE ADVENTITIOUS ROOTS.—The microscopical structure of these roots agrees very closely with those in the other species. The transverse series, in fact, presents no new features.

If the axis-cylinder be examined under a high power, Plate X., Fig. 38, the various tissues are found to present very characteristic root-like features. The xylem-strands stand out conspicuously, and between them lie the smaller fine-walled cells of phloem. A well-marked endodermis and pericycle may also be seen. The conspicuous ring of dark-walled cells belongs to the endodermis. The ring just inside it is the pericycle, whose cells, especially those opposite the intervals between the xylem-strands, are in an active state of division. Immediately outside the endodermis ring occur groups of cells with distinctly-marked dot-like cuticularisations on their radial walls.

Those roots originate from medullary rays, which become much broadened out and swollen at their ends (Plate XI., Fig. 42). The cambium of the stem becomes arched in a vaulted manner, and runs round the periphery of the club-headed medullary ray. As the internal protuberance increases in size, the cortex of the twig is raised up into a papilla. The phellogen-layer does not appear to take any part in the formation of this papilla. Ultimately the periderm is ruptured and the root is seen protruding through the torn ragged collar just like an ordinary soil-root (Plate XI., Fig. 43). It will be seen from this figure that the cambium of the stem is directly continuous with that of the root; further, the continuation of the root back into a wedge-shaped medullary ray is quite apparent. To the left of the old root may be seen a younger one in course of development.

In the apple-stem the endodermis is by no means a well-defined layer, but the pericycle may be recognised by the patches of thick-walled sclerenchyma-fibres, which are developed in it. The cells of the pericycle between those patches are of a parenchymatous nature. The hard sclerenchyma-strands offer considerable resistance to the outgrowing root. Those on the flanks of the root become bent out of their course and displaced to one side. Those directly in front are forced outwards to some

slight extent, but, being held firmly in position by their long spindle-form and their pointed ends dovetailing into each other, they gradually cut into the soft protruding tissue of the root. Such a patch may be seen to the right in Plate XI., Fig. 43, lying at the bottom of the deep incision which it has made in the cortex of the root.

A comparatively early stage of development is shown in Plate XI., Fig. 42, which is a section transverse to the stem and longitudinal to the root-rudiment. That this structure has nothing whatever in common with the vascular supply to the leaves or buds was easily seen on comparing it with a transverse section of a normal stem. We have here a medullary ray which has become abnormally broad and developed a large swollen apex projecting into the cortex and causing a corresponding papilla to appear on the outside. Over the apex of the protruding medullary ray may be seen a dark semi-circular cap, which is formed by the crushed and flattened remains of cortical cells, against which the apex of the outgrowing protuberance is pressing. The continuation of the cambium round the swollen end of the ray can be traced.

The dense coral-like masses at the base of the shoot (Plate X., Figs. 36 and 37), are formed by closely-packed adventitious roots which branch copiously.

Elm.

There are various elm-trees (*Ulmus campestris*) in the Garden which have likewise thrown out numerous peg-like protuberances which, on microscopical examination, were also found to be medullary ray-roots. Plate XI., Figs. 44 and 45, give a general impression of the appearance and arrangement of those adventitious structures. In a radial longitudinal section of both stem and adventitious root (Plate XI., Fig. 49), the continuation of cambium and xylem of the stem into the papilla can be easily traced. In transverse section those excrescences showed distinct root-like characters.

The aerial roots in this tree had not pierced the periderm or cork-layers of the stem, and it would seem that, for a time at least, the phellogem keeps pace with the outgrowing root. On this tree I have not yet observed any cases where the cork-layer has been broken through.

In addition to this specimen there are two wych elms (*Ulmus montana*), not far from the palm-house, which bear at their bases the large burrs so characteristic on many trees of this species. Numerous water-shoots have sprung up round their bases, forming a thick cover. These water-shoots all bear well-developed protuberances, especially on their under side, which resemble in appearance and agree in structure with those seen in Plate XI., Figs. 44 and 45. However, those adventitious roots were not confined to the branches alone, but were also to be found scattered over the surface of the burrs, which were, as usual, thickly covered with small adventitious shoot-buds, nevertheless a careful examination showed that many root-rudiments which might have been easily passed over for buds were also present. The size and shape of both structures were fairly similar, but the absence of bud-scales soon led to the detection of the root-rudiments which sometimes, though rarely, grow out into aerial roots. (See Plate XI., Fig. 48, which is a piece cut out of one of the burrs.) A radial longitudinal section of a bud (Plate XI., Fig. 48), and of a root-rudiment (Plate XI., Fig. 47), show distinctly the characteristic differences between those structures. The two specimens seen in these two figures were picked off a burr on which they were growing side by side.

Mountain-Ash.

Quite recently I came across the same phenomenon in a mountain-ash (*Pyrus Aucuparia*), which bore several large burrs near the base of its stem. The adventitious roots produced on the burr in this specimen were large, well developed, and abundant.

Cross sections of the burrs (of both elm and mountain-ash) show that the inward prolongations of these roots cause the vascular tissues to assume a very irregular course. In fact the effect of these adventitious roots on the vascular tissues of the burr is very much the same as that of the adventitious buds described by Professor Marshall Ward.[1]

Cherry-Laurel.

There yet remains to be mentioned the occurrence of those adventitious roots in the cherry-laurel.

[1] Marshall Ward, Disease in Plants (1901), p. 224.

I have found that the branches which bear those structures invariably die prematurely. The appearance presented by such a branch is illustrated in Plate XI., Fig. 50, where opposite sides of an abnormal branch are shown.

So far I have found on the dead branches, without exception, the fructification of one and the same fungus, but as yet I do not know whether the fungus may have anything to do with the formation of the aerial roots or not.

In Fig. 50 the part of the stem which produced the roots is dead, but just below the place where the roots ceased to come off were two branches which were still living.

General Remarks.

In discussing the occurrence of abnormally broad medullary rays, Kuster[1] gives, in a foot-note, a reference to an article by Sorauer[2], of which I append an extract.

"The canker-like 'Rindhypertrophe' of the rose, which, according to Sorauer, is probably due to over-feeding, is accompanied by certain abnormalities in the structure of the wood. Those abnormalities consist in the formation of four abnormally broad medullary rays, which run from the pith to the periphery of the wood, dividing it into regular compartments. The tissue of the bands is composed of very porous wood-parenchyma. On two opposite arms of those abnormally broad medullary rays adventitious bud-rudiments were formed in the cambium-zone, which had produced a thick wood-cylinder pointing in an outward direction, but had not pierced the outer tissues. In the neighbourhood of these internal bud-cones all the elements were increased."

Further, Frank[3] mentions the fact that adventitious buds arise on the roots of *Pyrus japonica*, *Rubus*, *Prunus*, and others from primary medullary rays.

It would therefore appear that medullary rays are capable of giving rise to adventitious shoots in some cases, in others to adventitious roots. It would be interesting to know the conditions which determine whether the adventitious organ is to be

[1] Kuster, Pathologische Pflanzen Anatomie (1903), p. 182.
[2] Sorauer, Zeitschrift fur Pflanzenkrankheiten, Vol. VIII (1898), p. 220.
[3] Frank, Lehrbuch der Botanik, Vol. II (1893), p. 52.

root or shoot, because the potentiality of producing either certainly resides in the medullary ray.

The conditions which govern the production of the adventitious roots have, so far as I know, not yet been determined. Certainly moisture plays a very important role in their subsequent development, as it is only in the moistest situation that they persist for any time after they pierce the periderm. This was very well marked in *Thuja*.

Conclusions.

1. The medullary rays of *Cupressus Lawsoniana*, *Thuja gigantea*, *Cupressus pisifera*, *Cupressus pisifera plumosa*, *Acer*, apple, and elm may become broad and cylindrical and be continued out into adventitious roots.

2. Such abnormal medullary rays and adventitious roots may be produced abundantly on the burrs found on elm and mountain-ash.

3. Those adventitious roots may cause, like adventitious buds, bird's-eye formation in wood.

4. In none of the above cases, except possibly the cherry-laurel, did the formation of these adventitious structures appear to be the result of mechanical injury, fungus, or insect attack.

I have to express my indebtedness to the Regius Keeper for much valuable advice and the many facilities afforded to me while engaged in carrying out the investigations of which the above is a record.

Explanation of the Figures in Plates VIII.-XI.

PLATE VIII.

FIG. 1.—Willow tree trunk, bearing numerous adventitious roots.

FIG. 2.—Gean tree stem, with swollen base showing numerous adventitious roots.

FIG. 3.-- Gean tree, piece of bark cut from the stem at a height of several feet from the ground, showing cluster of adventitious roots.

FIGS. 4-12.—*Cupressus Lawsoniana.*

FIG. 4.—Section transverse to stem and longitudinal to adventitious root.

FIG. 5.—Section radial longitudinal to both stem and root.

FIG. 6.—Longitudinal section of papilla caused by medullary-ray root.

FIG. 7.—Rhizogenous medullary-ray as seen in transverse section of stem.

FIG. 8.—Passage of rhizogenous medullary-ray through cambium of mother stem.

FIG. 9.—Axis cylinder of rhizogenous medullary-ray root in transverse section.

FIG. 10.—Transverse section of rhizogenous medullary-ray root showing axis cylinder and cortex.

FIG. 11.—Section longitudinal tangential to wood-body of stem showing rhizogenous medullary ray in transverse section.

FIG. 12.—Twig showing adventitious roots.

FIG. 13.—*Cupressus gigantea.* Section transverse to stem and longitudinal radial to medullary-ray root.

PLATE IX.

FIGS. 14-25.—Maple tree.

FIG. 14.—Tree showing numerous adventitious roots.

FIG. 15.—Part of a limb of the tree seen in Fig. 14 on nearer view.

FIG. 16-17.—Portion of two other trees showing adventitious roots.

FIG. 18.—Portion of stem in Fig. 17 enlarged.

FIG. 19.—Root cluster with portion cut away to show appearance of the wood.

FIGS. 20, 21, and 22.—Cylinders extracted by means of Pressler's Increment Borer to show connection of root with parent stem.

FIGS. 23 and 24.—Young adventitious roots in longitudinal section.

FIG. 25.—Passage of rhizogenous medullary-ray through wood body, cambium and bark of parent stem.

PLATE X.

FIGS. 26-30.—Maple tree.

FIG. 26.—Median longitudinal section of adventitious root.

FIG. 27.—Part of Fig. 26 enlarged.

FIG. 28.—Transverse section near base of adventitious root.

FIG. 29.—Cork layer forming across base of old adventitious root.

FIG. 30.—Transverse section near apex of adventitious root.

FIGS. 31-38.—Apple tree.

FIG. 31.—Branches producing coral-like clusters of adventitious roots.

FIGS. 32 and 33.—Twig which was first inverted so that adventitious roots first grew down towards the tip (Fig. 33). On being reinverted adventitious roots again show positive geotropic curvature (Fig. 32).

FIG. 34.—Twig kept horizantal. Adventitious roots have developed on lower side.

FIG. 35.—Adventitious roots developed in 36 hours in warm, moist chamber.

FIG. 36.—Coral-like mass of adventitious roots developed at base of long branch.

FIG. 37.—Long branch with spur shoots, showing coral-like mass of adventitious roots at their bases.

FIG. 38.—Transverse section of adventitious root.

PLATE XI.

FIGS. 39-43.—Apple tree.

FIGS. 39, 40, and 41.—Twig one of whose adventitious roots was caused to grow into a glass tube filled with moist sand. Fig. 39, before tube was attached. Fig. 41, with tube attached. Fig. 40, after tube was removed.

FIG. 42.—Transverse section of stem showing beginning of adventitious root by dilation of medullary-ray.

FIG. 43.—Section transverse to stem and longitudinal to adventitious root which has pierced the periderm.

FIGS. 44-49.—Wych elm.

FIGS. 44 and 45.—Stems showing numerous adventitious medullary-ray roots.

FIGS. 46-47.—Longitudinal sections of bud and root-rudiment from burr on which they were growing side by side.

FIG. 48.—Pieces taken from burr showing elongated adventitious roots.

FIG. 49.—Section radial longitudinal to stem and adventitious medullary-ray root.

FIG. 50.—Cherry laurel branch with numerous adventitious roots.

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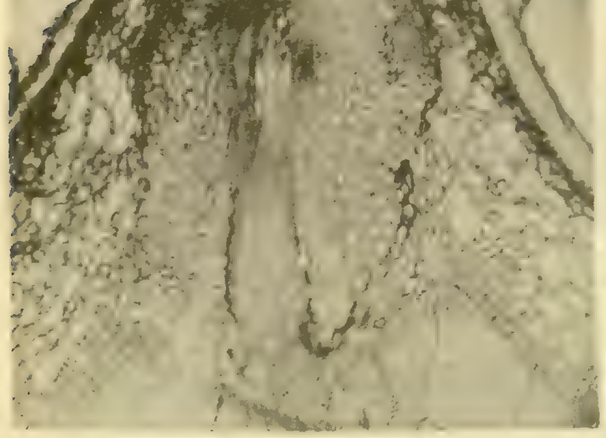

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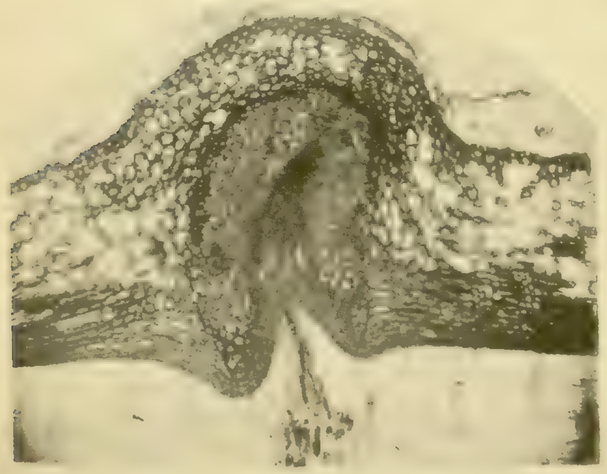

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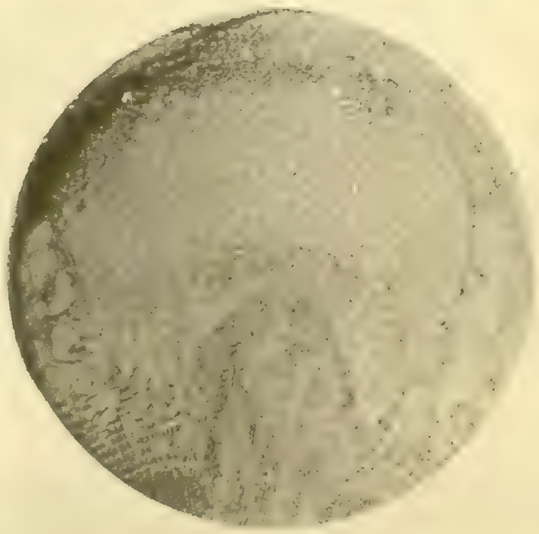

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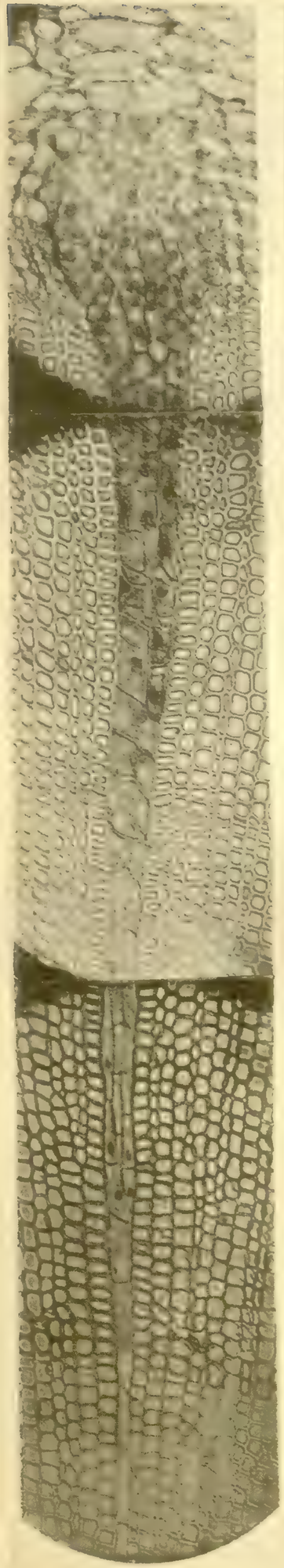

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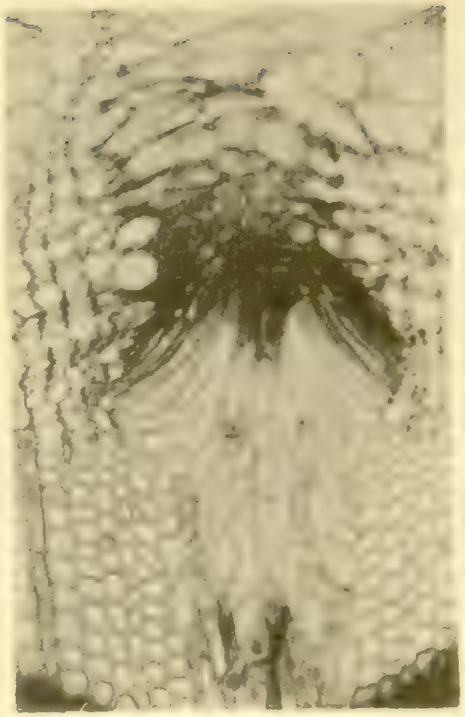

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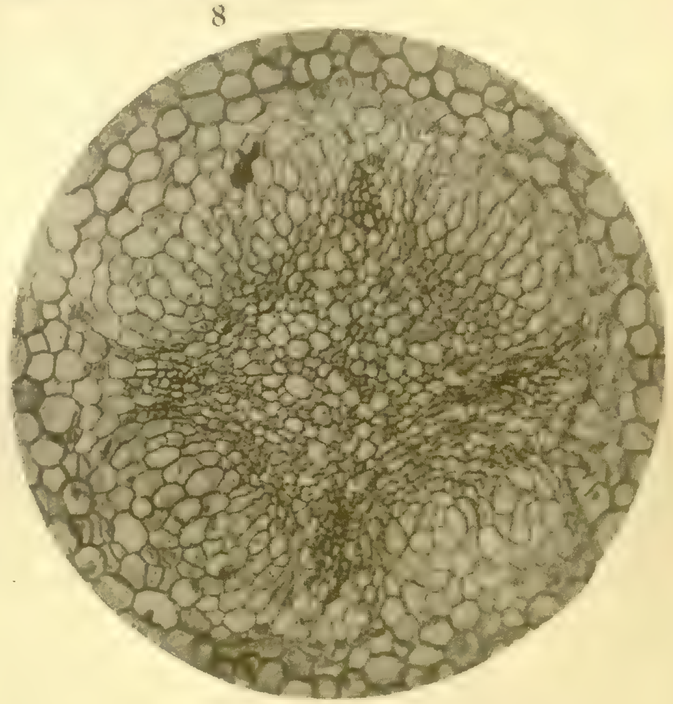

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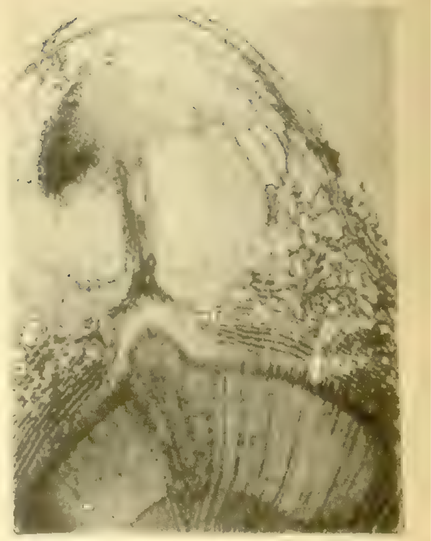

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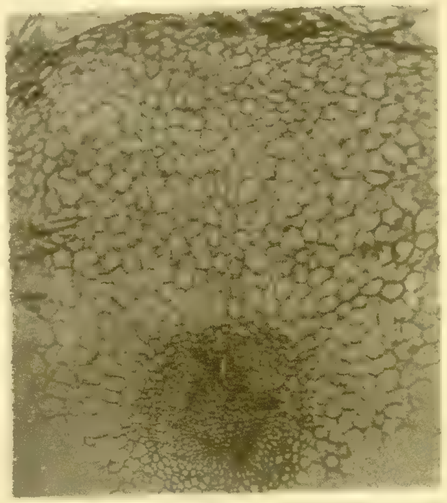

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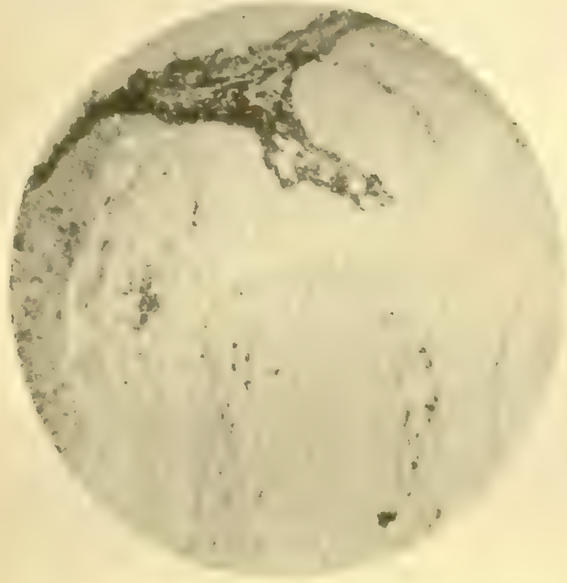

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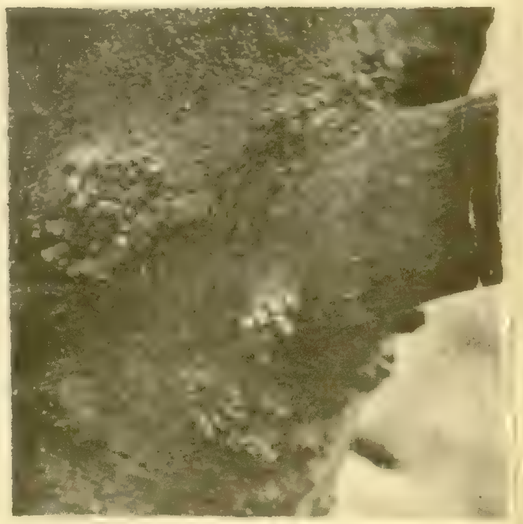

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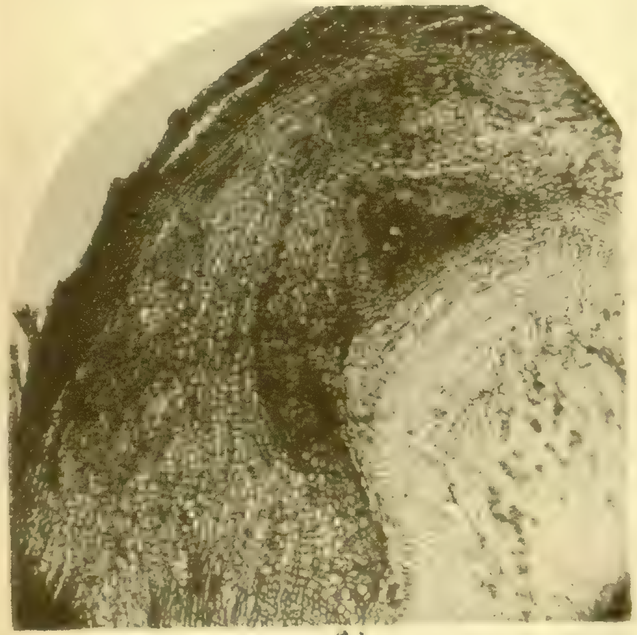

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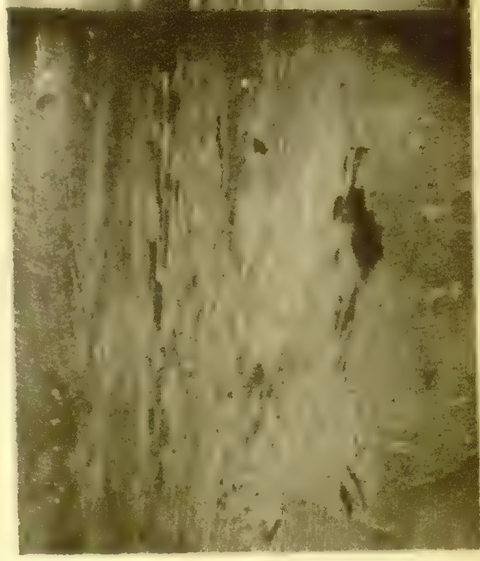

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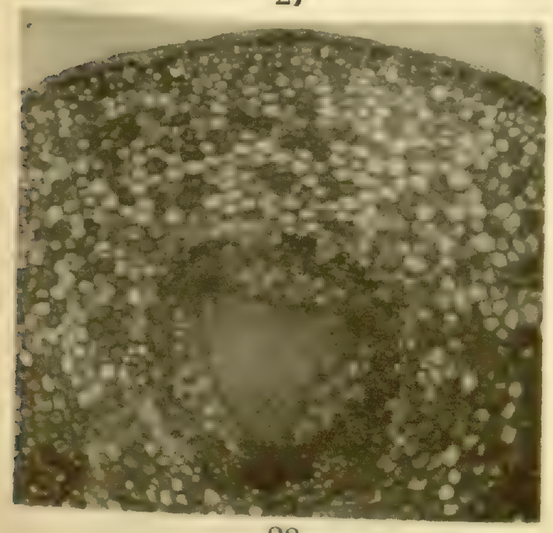

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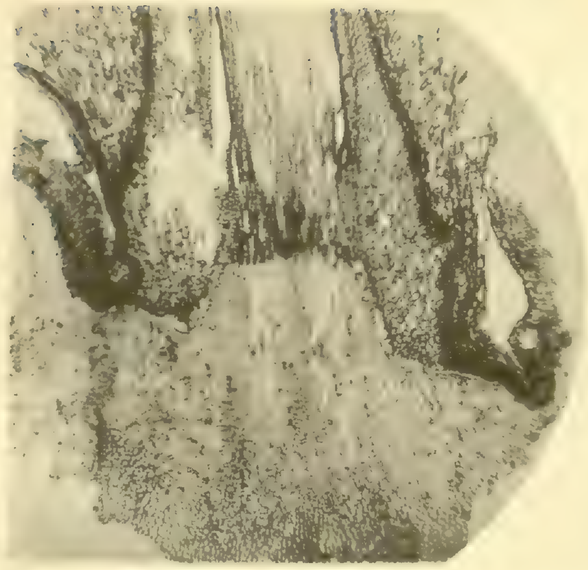

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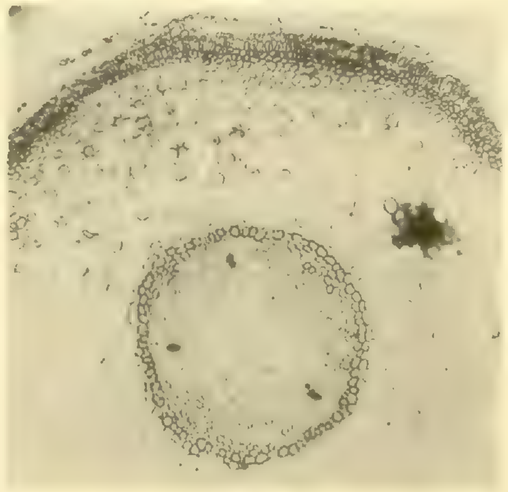

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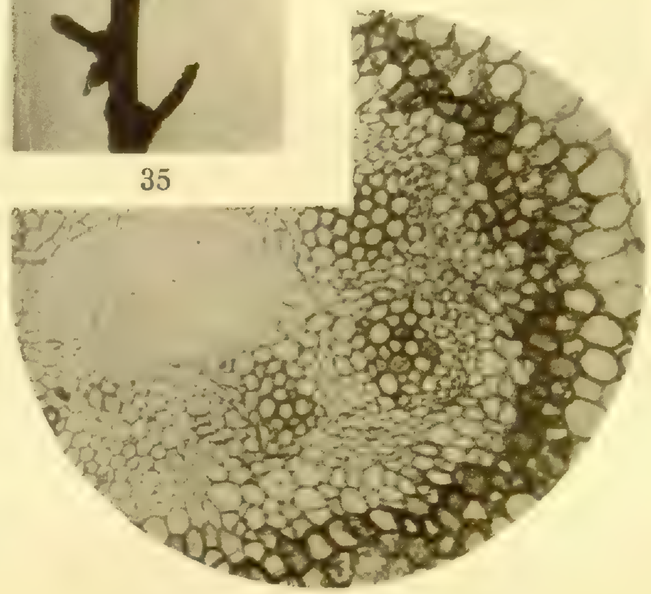

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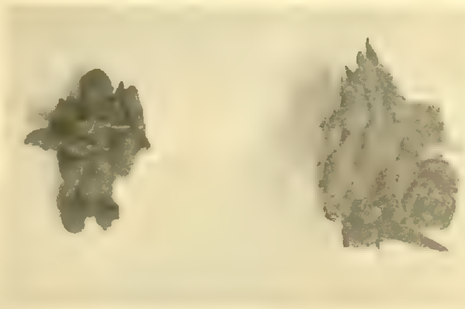

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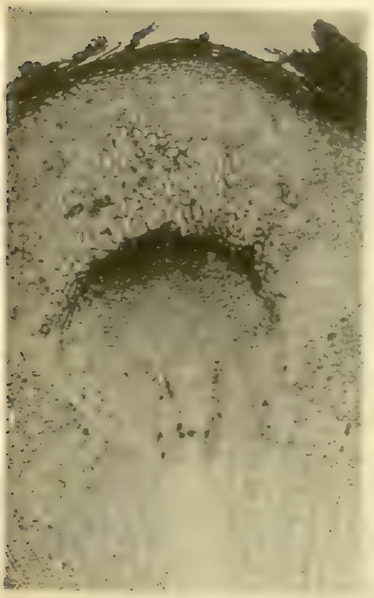

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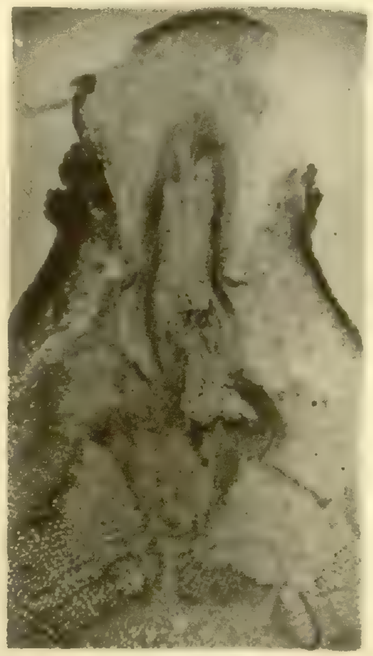

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NOTES

FROM THE

ROYAL BOTANIC GARDEN, EDINBURGH.

APRIL 1907.

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Additional Observations, since 1897, on the Girth-increase of Deciduous Trees in the Royal Botanic Garden, Edinburgh, and their connection with the Twenty Years' Observations (1878–97) previously published.

BY

DAVID CHRISTISON, M.D., LL.D.

INTRODUCTION.

The results of the observations begun by my father in 1878, and continued by me after his death in 1882, have been published from time to time down to the year 1897.* They principally deal with, and determine with sufficient accuracy, the average annual and monthly rates of girth-increase in a large number of deciduous trees. In accordance with the tapes then in use, the records were kept in twentieths of an inch. But the introduction of the fine steel tape of Chesterman, graduated to millimetres, insured an accuracy previously unattainable, and all my measurements since 1897 have been taken with this tape, the records being kept in millimetres, and even in half-millimetres. As my confidence increased, I initiated new inquiries and reduced the intervals of the observations to five days in general, besides recording occasionally, for short terms, at intervals of two days or daily, and finally three times a day.

For purposes of comparison, and to link on the new with the old records, it was necessary to reduce the parts of an inch in

*1. *On the Exact Measurement of Trees*. By Sir R. Christison, Baronet. Trans. and Proc. Bot. Soc., Edin., 1879-80-81.

2. *Observations on the Annual and Monthly Growth of Wood.* Sir R. Christison and Dr. D. Christison. Trans. R.S.E., XXXII., Part I., p. 46.

3. *The Weekly Rate of Girth-increase in Trees, and its Relation to the Growth of the Leaves and Twigs.* Trans. and Proc. Bot. Soc., Ed., 1891. Dr. Christison.

4. *The Girth-increase of Trees in the Royal Botanic Garden, Edinburgh, for Twenty Years* (1878-97). Notes, R.B.G., Edin., No. III, 1900; No. IV., 1901.

[Notes, R.B.G., Edin., No. XVII., April 1907.]

the latter to millimetres, a laborious task accomplished by help of Dowling's invaluable Metric Tables.

My method of measuring, and the precautions taken in selecting suitable trees are fully explained in the "Notes" (4), Royal Botanic Garden, Edinburgh, and need not be repeated here.

DIVISION OF THE SUBJECT.

From the beginning of the observations certain objects were kept specially in view, and subsequently others suggested themselves and were duly followed up. Thus, ultimately, a considerable number of lines of inquiry were established, so distinct from each other that they can be treated in separate and more or less independent chapters. In considering them, the most convenient plan will be to take the later results first and work gradually back to the earlier ones, republishing the latter only when necessary. Finally, the history of the trees individually throughout their whole career will be given.

The divisions of the subject will be taken in the following order :—

I. Effects of transplantation on girth-increase.
II. „ „ pruning „ „
III. Fluctuations in girth-increase (*a*) in frost, (*b*) in open weather.
IV. Annual and monthly girth-increase.
V. The beginning and end of girth-increase in the growing season.
VI. Progress of girth-increase in the growing season.
VII. History of the trees individually.

As it seems undesirable to delay publishing the results until the whole of them have been digested, the first instalment is now offered, containing the first two divisions.

PRELIMINARY REMARKS ON THE EFFECTS OF TRANSPLANTATION AND PRUNING.

When the square park surrounding Inverleith House was joined to the Botanic Garden in 1876 to form an Arboretum, a considerable amount of timber, from about 50 to 100 years old,

or thereby, stood upon it. But besides this, before the ground was handed over to the officials of the Garden, shelter belts of young trees were planted on the north, west, south, and part of the east sides.

When it became desirable to thin the belts, the selected trees were removed to new sites, the formation of the main avenue at the foot of the bank on the south side of the house, and of groups of the different species, being chiefly kept in view. Re-arrangements necessitated a second transplantation in not a few instances, and the removal of several much older trees from the Botanic Garden to the Arboretum was also undertaken.

The general method of transplantation followed has been to remove infant trees without any previous preparation, but with trees from about 6 or 8 to 18 or 20 inches in girth the outer roots were severed by cutting a circle in the ground round the tree, which was left standing for a year, or even for two years, to encourage the growth of new roots in the enclosed "ball" of earth. When transplanted the twigs were slightly pruned. In the case of unusually large trees—from 3 to 4 feet or nearly 5 feet in girth—the circular cut became a trench 4 feet deep.

Another practice seriously affecting the girth-increase, and introduced about the same time, was the pruning of trees into a conical sharp-pointed form to promote upward growth.

As most of the trees selected by me for observation soon after the establishment of the Arboretum were in the shelter belts, it was unavoidable that many of them should be transplanted, and of those that remained some were prepared for removal, and others were closely pruned for upward growth; thus my records were dislocated, at a varying number of years after their commencement, from these three distinct causes. The period before interference lasted in nearly every case long enough to determine what may be called the natural annual rate of girth-increase, and, as in most cases eleven years have elapsed since interference, not only have the immediate effects on the rate been well established, but the rates for several years after recovery from the operations have also been generally determined.

I.—EFFECTS OF TRANSPLANTATION.

(*a*) Trees of a Considerable Size.

1. Five trees of unusual size for transplantation were removed in the spring of 1896 from the Botanic Garden to the Arboretum. They varied between $3\frac{1}{4}$ and nearly 5 feet in girth, and along with them came a sixth of the more ordinary girth of 1 foot 8 inches. One of the larger size, *Pyrus Aria*, failed to recover and was cut down in 1901, so that it may be left out of account. The rate of increase after transplantation of the other five is given in Table I.

Although, on the whole, the aggregate rate is progressive, it has not been regularly so. Thus, it was rather less in the second year than in the first, and it was considerably less in the sixth than in the fifth year. It was equal in the seventh and eighth, but decidedly less again in the tenth than the ninth.

TABLE I.

No.		Girth, March, 1896.	Increase in Millimetres.						
			1896	1897	1898	1899	1900	T.	Av.
1.	*Pyrus rotundifolia*,..	Met. 1·027	1·3	1·3	3·8	7·6	6·3	20·3	4·06
2.	„ *communis*, ..	1·223	2·5	2·5	..	1·3	5·1	11·4	2·28
3.	*Cratægus oxyacantha*,	1·123	2·5	1·3	2·5	5·1	5·8	15·2	3·04
4.	„ „	0·527	..	–1·3	1·3	2·5	7·7	10·2	2·03
5.	*Juglans regia*, ..	1·443	..	1·3	1·3	..	3·8	6·4	1·28
			6·3	6·3	8·9	16·5	26·7	63·5	12·7
				–1·3					
				5·0					

No.	1901	1902	1903	1904	1905	T.	Av.	Girth, Oct. 1906.	Increase, Millimetres.
1.	3·8	11·4	10·2	10·2	7·5	43·2	8·65	1·100	11
2.	–3·8	3·8	..	12·7	3·8	16·5	3·30	1·241	5
3.	8·9	8·9	10·2	14·0	19·0	61·0	12·20	1·217	18
4.	7·6	10·2	12·7	15·2	10·2	55·8	11·16	0·613	19
5.	..	1·3	2·5	2·5	..	6·3	1·26	1·457	2
	20·3	35·6	35·6	54·6	40·6	182·8	36·6		55
	–3·8								
	16·5								

In the quinquennia the rate of the second was nearly three times that of the first, the aggregate results being 63.5 and 182.8 mil., and the averages 12.7 and 36.6.

THE TREES SEPARATELY.

1. PYRUS ROTUNDIFOLIA.

The recovery in the general appearance of the foliage was slow, and did not seem to be complete till 1905. There was no loss of branches, and the head of foliage is now large and dense. The stem is about 3 feet 7 inches in girth and 14 feet in height, and the total height of the tree is 39 feet.

The rate of girth-increase was progressive on the whole, that of the second quinquennium being double that of the first, but it was irregular from year to year. The average for the last five years, 8·6 mil., or about a third of an inch, and the last year's rate of 11 mil. must be low, if we may judge from another of the same species in the Rosarium of the Botanic Garden, which has a stem 14 feet in height, girthing 6 feet 3½ inches (2·015 mil.), and is perfectly symmetrical, and crowded with foliage, which has a circumference of 165 feet.

2. PYRUS COMMUNIS.

This tree has not done so well as the last, and although the foliage is now healthy and fairly abundant, it shows awkward gaps from the death of branches. The girth is now barely 4 feet 1 inch and is only about ¾ inch more than eleven years ago. The stem is 12 feet high and the tree 44 feet.

The average annual rates for the two quinquennia were 2·28 and 3.3 mil., but there was great annual variation—from a loss of 3·8 in 1901 to a gain of 12·7 in 1904. The increase in 1906 was only 5 mil.

3. CRATÆGUS OXYACANTHA, var. PLENO FLORE RUBRO.

The progress of the foliage to a healthy condition was not much quicker in the two hawthorns than in the pears, but the girth-increase began to improve earlier and went further.

In No. 3 the average annual rates in the two quinquennia were about 3 and 12 mil., and the increases of 19 and 18 in the years 1905 and 1906 augur well for the future of a tree of the species already 4 feet in girth, 34 feet high, with a bole of 9 feet.

4. CRATÆGUS OXYACANTHA, var. FLORE PLENO.

This considerably smaller hawthorn followed much the same course as No. 3, but the quinquennial averages of about 2 and 11 mil. were rather less than in it, and the increases of 10 and 19 in 1905 and 1906 compare unfavourably, considering the smaller girth, barely 2 feet, of No. 4.

5. JUGLANS REGIA.

This remarkably handsome walnut is the largest "transplant" in the Garden. When operated on it measured within 3 inches of 5 feet in girth, and had a stem of 17 feet and a total height of 50 feet. With its ball of earth it must have weighed about 7 tons.

After transplantation its progress, if progress it can be called, was exceedingly slow, and it was no better in the second than in the first quinquennium, the amounts being 6·4 and 6·3 mil., or 12·7 in ten years.

The annual increase was *nil* in 1896, '99, 1901, '05; and the greatest amount in any one year was 3·8 in 1900. This is a disheartening record; nevertheless, the tree retains its fine appearance, and, if the foliage continues to be very poor, it is not unhealthy and there are few dead twigs. It is to be hoped, therefore, that recovery will eventually be complete, and that an interesting proof may be furnished that a tree, after "marking time" for at least ten years, may enter on a fresh career of progress.

The results in *Cratægus Oxyacantha*, No. 16, another large hawthorn, may appropriately be given here. The effects of transplantation in this tree were complicated by the effects of frost. So far back as 1878 this was by far the finest hawthorn in the Garden, symmetrically clothed with dense foliage to the ground. It girthed 3 feet 2 inches and the increase of that year was 20½ mil., but the disastrous frost of that winter brought it down to 2½ in 1879: in 1880 it rallied to 19, but the hard frost of that winter

reduced it to 9 in 1881. For the next ten years the rate was $14\frac{1}{2}$.

It was prepared for transplantation by pruning and cutting round the roots in autumn, 1894, when 3 feet 8 inches in girth, and quite retaining its handsome look; but it was allowed to stand for five years more, the girth-increase rate falling to 4 mil. In 1899 it was removed to the south walk of the Arboretum, when it was noted that a great mass of roots had formed in the ball of earth. But the increase since the operation has fallen almost to zero. and the tree is a complete wreck, though still allowed to stand. This result was doubtless mainly caused by the tree having been twice blown down after transplantation. On the second occasion the holding stays were broken, and the tree torn out of the ground, the roots being broken across, and the soil shaken from them.

(*b*) Trees of Smaller Girth.

In the Tables under this head the results before and after transplantation are separated by a double line, and are expressed in millimetres.

ACER PSEUDOPLATANUS. No. 67.

Girth, March, 1887=0·175 mil.

Trd.

	1887-1889			1890	1890-94	1895-99	1900-04	1905	1906
Amount,.. ..	2½	5	7½	12¾	82½	105½	112	21½	23
Rate, ...		5		..	16½	21	22½	22½	

Transplanted in spring, 1887, to an open grassy space, where it still stands, quite free, but well sheltered. When transplanted it was an infant, girthing only $6\frac{3}{4}$ inches. Since then it has only been interfered with by pruning to promote upward growth.

The rate of increase before transplantation is unknown, but ought to have been, and no doubt was, much above the 5 mil. of the following three years. In the next year the amount sprang

up to 12¾ mil., indicating that the effects of transplantation were over, particularly as the quinquennium, then beginning, yielded an average of 16½, and the next one 21. This was, apparently, in accord with the upward march of adult life, but hardly any further development has occurred in the final seven years, such as might be expected in a sycamore 20 inches in girth.

The annual records show that in the last ten years the most flourishing period was in 1899, 1900, and 1901, when the increases were 25½, 28, and 26½ mil., and that there was a sudden drop to 14 in 1903.

1897				1901					1906
21¼	21¼	25¾	28	26½	21¼	14	21¼	21¼	23

The foliage, although always healthy, has not the density usual in sycamores. Its rate of increase also compares unfavourably with that of the following two trees of the same species.

ACER PSEUDOPLATANUS. No. 71.

Girth, March, 1887=0·214 mil.

	1887–1890	1891–96	1897–1898	1898
Amount, ..	108	182¼	0	Died
Rate, ...	27	30¼	0	..

This young tree, barely 8½ inches in girth in 1887, throve well for the eight years when it stood in the south shelter belt of the Arboretum, its annual rate being nearly 30 mil., but it did not survive removal.

ACER PSEUDOPLATANUS. No. 74.

Girth, March, 1887=0·233 mil.

	1887–1890	1891–1895	1895	1896–1899	1900	1900–1905	1906
Amount, ..	106¾	186¾	39¼	3¾ 7½ 6½ 10	22¾	184¾	28
Rate, ..	26¾	37½	..	7	..	30·7	..

A companion of the last, and not ¾ inch larger in girth, No. 74 was transplanted at the same time, but with a better fate. It grew at the same rate as No. 71 in the first four years, but in the next five got ahead of it, the respective rates being 30½ and 37½. After removal to its present open grassy situation near the old walnut in the Arboretum, its rate for four years was only about 7 mil., the decline in the first year being extreme—from 39¼ to 3¾. In 1890 the rate jumped to 22¾, and in the six years 1900–1905 averaged 30, but was slightly less—28—in 1906. That this rate did not equal the rate before transplantation may be due to the clearing of the dense plantation in which the tree was growing at first, and to its exposure in its present position.

ÆSCULUS HIPPOCASTANUM. No. 73.

Girth, March, 1887=0·173 mil.

Trd.

	1887–1895	1895	1896	1897–1901	1902–1906
Total,.. ..	185½	15¼	6¼	129½	165
Average, ..	20½	..	..	26	33

Girthing about 7 inches when first measured, No. 73 increased at the rate of 20½ for nine years. In the last of these years the increase was only 15¼, due, probably, to pruning of branches and roots to prepare for transplantation. This was in 1895, and in 1896 the increase fell to 6¼; but next year it rose again to 15¼, and the career of the tree ever since, in its new situation near the ruins of the old walnut, has been prosperous, the rate from 1897 to 1901 having been 26, and from 1902 to 1906, 33.

ÆSCULUS HIPPOCASTANUM. No. 80.

Girth, March, 1887=0·187 mil.

	Trd. 1887–1891			Trd. 1895–1896	1897–1902	1902–1904			1906–1906	
Total, ..	150	2¼	10 12¾	63½	102¼	3¾	3¾	6½	17½	22
Average,	30	8½		31¾	20½	4¼			20	

Girthing 7½ inches when first measured in 1887, this companion of the last had the apparently high rate, for so young a tree, of 30 mil. for five years. Transplanted in 1892, it took three years to recover instead of one, as in No. 73. The recovery was complete, the rate rising for two years to 31·5; but, as the result of pruning and retransplantation in 1902, followed by a fungoid disease of the bark, the rate fell for the three years 1902–04 to 4½, and the tree had a very shabby appearance. The diseased bark was extirpated, and a cure apparently effected, as the appearance of the tree is much improved in the last two years, and the rate of girth increase has risen to 20.

ALNUS GLUTINOSA. No. 88.

Girth, March, 1887=0.242 mil.

	1887–1889	1890–95	1896 Trd.
Total, ...	73¼	92¾	Languished and died in 1900
Average, ..	24¼	15⅓	

The rate of this alder, 9½ inches in girth in 1887, was 24½, for three years, which seems good. It then fell off for the next six years to 15½, and after transplantation in 1896 the tree did no good for four years and was cut down.

BETULA ALBA. No. 78.

Girth, March=0.237 mil.

	1887–1894	1894	1895 Trd.	1898
Total, ...	232	31¼	2½ 11½ 5	Cut down
Average, ..	29	..	6¼	..

This birch, 9⅓ inches in girth, promised to be a fine tree, having had a rate of 29 mil. for eight years before transplantation in 1895. In the previous year the increase was 31¾, but it fell to 2½ in 1895, and after lingering on for two years more, with increases of 2½, 11½ and 5, the tree died in 1898.

CARPINUS BETULUS. No. 81.

Girth, March, 1887=0.186 mil.

	1887–1891	1892	1893–1894	1895–1904	1905–1906
	Trd.		Trd.		
Increase, ..	89	11½	0 9	199	..
Average, ..	18	..	4½	20	2

This hornbeam, 7½ inches in girth in 1887, had a rate of 18 for five years. Next year the increase dropped to 11½, probably from the pruning before transplantation. After that operation in 1893 there was no increase in the first year, and it amounted to only 9 in the second, but for ten years thereafter the rate was 20. The tree was then—1895—again transplanted, and the average of 1895–96 was only 2.

CARPINUS BETULUS. No. 86.

Girth, March, 1887=0·150 mil.

	1887–1890	1891–1896	1896	1897–1906
	Trd.			
Increase, ..	53¼	120	21¼	57¼
Average, ..	13¼	20½	..	5¼

A companion of No. 81, originally in the south shelter belt, and even less in size, only 6 inches in girth, its rate was only 13¼ as an infant, but after four years it increased for six years to 20, or the same as in No. 81. Transplanted in 1897, the increase fell from the high 21½ of the previous year to 3¾, and the rate for ten years down to 1906, was only 5½, the minimum being 0 and the maximum 11½. The foliage in this period has been scanty, but not unhealthy, and, as it is gradually filling up, the tree may yet do well.

CRATÆGUS OXYACANTHA. No. 8 (formerly 19).

Girth, March, 1887=0.245 mil.

	1887–1892	1893–1895	1896–1898	1899–1904	1905–1 06
	Trd.		Trd.		
Total, ...	163¼	11½ 12¾ 21½	2¼ 1¼ 2¾	122½	3¼
Average, ...	27¼	15½	2	20	1¼

9½ inches in girth in 1887, this tree had a rate of 27¾ for six years, when it fell for three years to 15¼, probably from pruning. In the last of these years, however, the rate had improved to 21½ and the tree looked well. It was then transplanted, when the rate for three years fell to the excessively low amount of 2. Recovering a rate of 20½ in the period 1899–1904, it was again transplanted in spring, 1905. The increase for 1905–06 was only 3½, but the tree is well clothed with healthy foliage in 1906, and should now do well.

CYTISUS LABURNUM No. 21.

Girth, March, 1887=0·153 mil.

Trd.

	1887–894	1895–1896	1897–1904	1905–1906
Total, ...	168	3¾ 9	201	13
Average, ..	21	5¼	25	6½

Six inches in girth in 1887, this laburnum had the probably good rate, for so young a tree, of 21 for eight years. Transplanted then, the increase in 1895 was only 3¾; in 1896 it was 9; but recovered to 21½ in 1897, and a rate of 25 was kept up for eight years till 1904, when the tree was again transplanted. The rate for 1905–06 was 6½, and the tree seems in good condition.

FAGUS SYLVATICA. No. 97.

Girth, March, 1888=0·262 mil.

Trd.

1888	1893
29 33 38 22¼	1¼
122	Died
30½	

This fine young beech, 10¼ inches in girth in 1888, increased at the rate of 30½ mil. for four years. It was then transplanted, but died from the operation.

FAGUS SYLVATICA. No. 98.

Girth, March, 1888=0.205 mil.

1888					Trd.
25½	28	37	34½	39½	Died
		164			
		32¾			

This companion of the last, although only 8 inches in girth in 1888, had a similar rate for five years, but underwent the same fate from transplantation.

FRAXINUS EXCELSIOR. No. 75.

Girth, March, 1887=0.124.86 mil.

	1887–1894	1895–1898	1899	1899–1904	1905–1906
	Trd.			Trd.	
Total, ...	116	1¼ 6¼ 12¾ 14	25½	128½	8½
Average, ..	14½	8·5	..	21½	4¼

This young ash, measuring under 5 inches in girth at first, increased at the rate of $14\frac{1}{2}$ for eight years, when it was transplanted, with the result of a fall to $1\frac{1}{4}$ in 1895, an amount which was gradually improved upon for the next three years; but it was not till 1899 that real recovery took place, as shown both by the aspect of the tree and the sudden jump of the increase to $25\frac{1}{2}$, a rate which was somewhat diminished in the next six years, chiefly from a fall to $15\frac{1}{2}$ in 1904. It was then re-transplanted, and the rate for the final two years was $4\frac{1}{4}$. The general rate, which is apparently low, was no doubt kept down by pruning for upward growth.

FRAXINUS EXCELSIOR. No. 23.

Girth, March, 1887=0.146·05 mil.

	1887–1891	1892	1894	1894–1896	1897	1901
	Trd.			Trd.		
Total, ...	115½	7½ 6½	26¾	93	5 3¾ 5 7½	Died
Average, ..	23	7	..	31	5¼	

MO. BOT. GARDEN

A little larger than the last in 1887, this ash had a much better rate for five years. Transplanted in 1892, the rate fell to 7 for two years. A sudden rise to $26\frac{3}{4}$ proclaimed a complete recovery in the following year, and a rate of 31 gave good promise for the future. But, unfortunately, it was retransplanted, and after struggling feebly with a rate of $5\frac{1}{2}$ for four years it was cut down.

POPULUS FASTIGIATA. No. 9.

Girth, March, 1892=0.217 mil.

	Pruned.			Trd.					
	1892–1895	1895	1896–1899	1900–1901		1902–1906			
Increase, ..	125¾	33	71	25½	26¾	1½	1¼	5·00	6·00	11½
Average, ..	31½	—	17¾	26		5				

Only 8 inches in girth in 1892, this young poplar started with a rate of $31\frac{1}{2}$ for four years. Pruning reduced it to $17\frac{1}{2}$ for the next four years, but in the following two it improved to 26. The tree was then transplanted, and, although always looking well, the rate for the last five years has been only 5· ; for the first two of them it was almost nil, but in 1906 it had improved to $11\frac{1}{2}$.

POPULUS FASTIGIATA. No. 76.

Girth, March, 1887=0.209 mil.

	Trd.	
	1887–1892	
Increase, ...	186	Died
Average, ...	31	

About the same size as No. 9, this poplar had the same good rate for six years, when it was transplanted and died.

POPULUS FASTIGIATA. No. 7 (formerly 23).

Girth, March, 1899=0.620 mil.

	Trd.			
	1899–1901	1902	1902–1905	1906
Increase, ..	93	9	55	16
Average, ..	31	..	13¾	..

Girthing 2 feet in 1899, and with a rate of 31 for the next three years, transplantation reduced the increase in 1902 to 9; and, although the tree looked perfectly healthy and vigorous for the four years to 1905, the rate was only $13\frac{3}{4}$. In 1906 it rose to 16, but even this seems quite low, as it would be difficult to find a better clothed or healthier-looking tree of the kind, and it is not yet old.

PRUNUS AVIUM. No. 18.

Girth, March, 1887=0.116 mil.

	1887–1894 Trd.	1894 Trd.	1895 Trd.	1896–1899 Trd.	1900–1904 Trd.	1905 Trd.
Total, ...	158½	15½	0	86½	159½	—
Average, ...	20	..	..	21½	32	—

Only $4\frac{1}{2}$ inches in girth when first measured in 1887, this cherry stood in the south border of the Arboretum till 1894, with a rate of 20 mil. After transplantation in 1895 there was no increase for that year, but next year it at once regained the old rate and has improved since, so that in the period 1900–04 it had risen to 32 mil.—a remarkable record of rapid recovery. In 1905 the tree was again transplanted, but failed and was cut down.

PRUNUS AVIUM. No. 22.

Girth, March, 1887=0.165.97 mil.

	1887–1891 Trd.	1891 Trd.	1892 Trd.	1893 Trd.	1893–1901 Trd.	1902–1906 Trd.
Total,.. ..	162½	34¼	3¾	20¼	270	56
Average, ..	32½	..	..	..	30	11¼

A companion of the last and slightly larger—$6\frac{1}{2}$ inches in girth—its rate before transplantation—$32\frac{1}{2}$—was considerably higher than that of No. 18. Like it, the recovery took place after a single year of great depression. The rate, however, for the next 9 years was rather lower—30· —than before transplantation, although the tree seemed healthy. In 1902 it looked sickly and continues to do so, the rate from then till 1906, or for five years, being also

reduced to 11¼. The removal of shrubs growing under and close to it, and the substitution of grass sods for the earth on which it stood, are the only ostensible causes, but seem insufficient to account for such serious results.

PYRUS AUCUPARIA. No. 79.

Girth, March, 1887=0.274 mil.

	Trd. 1887–1891	1891	Trd. 1892–1893		1894	1894–1897	Trd. 1898–1901	
Total, ..	119½	23	3½	11½	20½	85	54	Died
Average, ..	24	..	7½		..	1½	13½	

The rate—24 for the first five years—seems good for a tree 10¾ inches in girth. It fell to 7½ for two years after transplantation, rose to 21½ for the next four years, but fell off for some unknown reason to 13½ from 1898 to 1901, when the tree was again transplanted ; but it never recovered, and died in 1894.

PYRUS AUCUPARIA. No. 77.

Girth, March, 1888=0.176 mil.

	Trd. 1888–1894	Trd. 1895–1896		1897	1897–1903	1904	1905	1906
Total, ...	112	1¼	9	19	110½	13½	5½	6
Average, ..	16	5		..	15½		8¼	

Only 7 inches in girth when first measured in 1888, this rowan had the low rate—compared with No. 79, a rather older tree—of 16 for seven years. Transplantion reduced it to almost nil in 1895, but in 1897 it reached its maximum—19—and for the period 1897–1903 the tree resumed almost exactly its rate, before removal, of 15½. In 1904, however, it fell to 13½, and in 1905–1906 to 5½ and 6. The cause is not evident, unless it was disturbance of the ground, due to removal of trees and shrubs near it. The tree looks healthy, but has a rather small head of foliage.

QUERCUS PEDUNCULATA. No. 1.

Girth, March, 1888=0.140 mil.

Trd.

	1888–1889	1890	1890–1894	1895–1896	1897	1897–1901	1902–1904	1905–1906
Increase,	10¼ 10¼	16½	77½	2½ 3¼	15¼	100	50	8 7
Rate, ..	10¼	..	15½	3	..	20	16½	7½

The low rate of 10¼ for the first two years may have been due to transplantation, as next year it rose to 16½, continuing nearly at the same for five years. Transplantation then reduced it for two years to 3. Next year—1897—it jumped to 15¼, and an enhanced rate of 20 was maintained till 1901, when it fell to 16½ for three years, possibly due to the removal of neighbouring trees and shrubs, which may have interfered with its roots. It was then retransplanted, and the increase in 1905 and 1906 fell to 8 and 7; but the tree looks well.

QUERCUS PEDUNCULATA. No. 2.

Girth, March, 1888=0.203 mil.

Trd.

	1888–1889	1890	1890–1895	1896–1898	1899–1901	1903–1904	1905	1906
Increase, ..	5 7½	16½	106¼	1½ 2½ 3¾	42	12	13	15½
Rate, ...	6¼	..	18	2½	14	6	14½	

This companion of the last, and a little larger at first, had a rather lower rate for the first two years, which probably succeeded transplantation, and a rather better rate than that of No. 1 for the next six years. It was transplanted a year later than the other, and took a year longer than it to recover. Even then the rate was low, and a depression to 6 for the two years 1903 and 1904 followed, which it is difficult to explain; a recovery to 13 in 1905 and 15½ in 1906 gives hope that the tree may yet do well.

QUERCUS RUBRA. No. 61.

Girth, March, 1887=0.131.76 mil.

Trd.

1886	1887–1889	1890	1890–1894	1895–1896	1897-1898	1899	1900–1906
—	2¼ 2¼ 7½	22¾	150	30½	9 6½	12¾	90
Rate,	4½	..	30	15¼	7½	..	13

Only 5½ inches in girth when transplanted in the spring of 1887, this handsome young oak nearly perished from the operation. In 1887 the foliage was very scanty, and in 1888 it entirely disappeared in consequence of the death of the young twigs of the previous year. It is therefore remarkable that an increase in girth took place in both these years, though only of 2¼. In 1889 there was an unexpected, though but slight, improvement in the aspect of the tree, and in 1890 the recovery was suddenly completed. The girth-increase rose to 22¾, and the excellent rate of 30 was maintained for five years. Consequent on preparation for a second removal, the rate dropped for two years to 15¼. After transplantation it fell for two years to an average of 7½, and in 1899 recovered to 12¾, a rate which it has not improved upon since.

Well placed in prepared ground on the north side of the Arboretum, the tree, nevertheless, has not yet recovered the well-clothed aspect and rapid rate of girth-increase that characterised the period from 1890 to 1894.

QUERCUS ILEX. No. 16.

Girth, March, 1887=0.107.08 mil.

Trd.

	1887–1893	1894	1894–1898	1899	1899–1905	1906
Total, ...	113	3¾	35	11½	79	11½
Average, ...	16	..	7	..	11½	..

This infant evergreen oak grew at the rate of 16 for seven years. Transplanted in 1894, the increase fell to 3¾ in that year and averaged 7 till 1898. A rise to 11½ in 1899 seemed to show

recovery from removal, but the rate till 1906 failed to improve upon these figures. Youth could not account for this low rate in the period 1899 to 1906, because the rate from 1887 to 1893 was considerably better, although in the infancy of the tree. Nevertheless, it is a healthy, vigorous looking, bushy tree and occupies a fine open situation in the Quercetum.

The largest evergreen oak in the Garden, much damaged by the great frost of 1878, was noted as being upwards of 6 feet in girth at that time, and perhaps has somewhat increased since, as in autumn 1906 it was 6 feet $7\frac{1}{2}$ inches at 3 feet; 6 feet 11 inches at 3 feet 9 inches; and 6 feet 9 inches at 5 feet.

TILIA EUROPŒA. No. 69.

Girth, March, 1887=0.237 mil.

	1887–1891	1892–1896	1897–1898	1899	1900–1901	1902	1903–1906
			Trd.		Trd.		
Increase, ..	$86\frac{1}{2}$	$105\frac{1}{2}$	0 0	14	$20\frac{1}{2}$ $22\frac{3}{4}$	0	$3\frac{3}{4}$ 12 $5\frac{1}{2}$ 12
Average, ..	$17\frac{1}{2}$	21	0	14	$21\frac{1}{2}$	—	$8\frac{1}{4}$

$9\frac{1}{2}$ inches in girth in 1887, this young lime increased at the rate of $17\frac{1}{2}$ for the first five years and of 21 for the second. Transplanted in 1896, it had absolutely no increase for the next two years, and grew only 14 in the third year. In 1900 and 1901 it resumed the rate of the second quinquennium. Retransplanted in 1902, it had no increase for one year, and has had the low rate of $8\frac{1}{4}$ since. Yet it looks healthy and as if it would do well eventually.

TILIA EUROPŒA. No. 85.

Girth, March, 1887=0.233 mil.

	1887–1891	1892–1896	1897	1898		1901		1906
					Trd.		Trd.	
Increase, ..	66	$82\frac{1}{2}$	$1\frac{1}{2}$	$16\frac{1}{2}$	0 9	$17\frac{3}{4}$	0	$2\frac{1}{4}$ 1 6 11
Average, ..	$13\frac{1}{4}$	$16\frac{1}{2}$	..	..	4·5	..	..	$7\frac{1}{4}$

A companion of No. 69, and of the same size in 1887, this tree had the lower rates of $13\frac{1}{4}$ and $16\frac{1}{2}$ in the first and second quinquennia, as compared with $17\frac{1}{2}$ and 21. For some unrecorded or unknown reason the increase in 1897 fell to $1\frac{1}{4}$; but in 1898 it sprung up to $16\frac{1}{2}$, and the tree must have been considered to be in good condition, as it was transplanted. Two years followed, the first with no increase, the second with only 9; but next year it amounted to $17\frac{3}{4}$, when the tree was again transplanted, once more with the result of no increase in the first year, and the rate for the succeeding four years down to 1906 was only $7\frac{1}{2}$. The tree looks healthy enough.

ULMUS MONTANA. No. 94.

Girth, March, 1888=9.270.51 mil.

	1888–1891	1892	1895	1895–1898	1899–1902	1903–1906
Total, ...	**144¾**	**2¼ 7½ 20¼**	**39½**	**143½**	**146**	**141**
Average, ..	**36¼**	**10**	**...**	**36**	**36½**	**35**

The wych elm is the most thriving and quickest growing tree in the town gardens of Edinburgh, and No. 94, with its former neighbour No. 93, are among the best of all the trees under my observation. They stood together in the original east belt of the Arboretum, which was done away with, No. 93 being almost the only tree that was not removed.

No. 94 is now a handsome spreading specimen in its new site in the main avenue of the Arboretum. Transplanted in 1892, its rate fell from an average of $36\frac{1}{4}$ to $2\frac{1}{2}$ in that year, and, improving in the next two years, had wholly recovered with an increase of $39\frac{1}{2}$ in 1895. Its rate for four periods between 1888 and 1905, excluding the three years when it was affected by removal, has been remarkably uniform, varying only from 35 to $36\frac{1}{2}$.

REMARKS.

Large Trees.—As far as can be judged from the small number of trees between 3 and nearly 5 feet in girth that were transplanted in 1896, the risk of death from the operation in trees of

that size is not excessive, as only one tree of the five perished. But if we take the hawthorn, No. 16, transplanted in 1899 and now standing without hope of recovery, the proportion of deaths is more serious.

In every instance recovery, both in appearance and in the rate of girth-increase, was slow. None of these trees could be regarded as healthy looking and handsome till from eight to ten years had elapsed ; and one, although by no means in a desperate condition, has still very scanty and ill-developed foliage, while another has scarcely any at all. As regards girth-increase, none of the trees have regained the rate that might be expected from their size. In three it is still very deficient, and in two of these girth-increase has either scarcely or not at all begun.

Probably the risk of failure increases with the size of the tree ; but, of course, the number experimented on is too small to warrant a conclusion on this point.

The final results, both in regard to appearance and girth-increase, in this group have still to be ascertained, and it will be very interesting to watch future developments.

Small Trees.—In all, 29 trees were transplanted, thirteen of them twice, making 42 actual cases.

In no less than 9, or 20 per cent., death resulted. Moreover, in ten others, eight of which were second transplantations, the recovery is not yet certain, although to all appearance the trees are healthy.

The period of depression after transplantation varied considerably.

It lasted one year in Nos. 7, 18, 22, 67, 69 (2nd time), 73 (2nd time), 74 ;
two years in Nos. 1, 9, 21, 23, 61 (2nd time), 69 (twice), 77, 79, 81 (2nd time), 85 ;
three years in Nos. 2, 8, 61, 80 (twice), 94 ;
four years in Nos. 16, 75.

The deficit in the girth-increase of trees that recovered fell to zero in 18, 69 (twice), 81, 85.

Average of 2 to 3 mil. in 1, 2, 8 ;
$3\frac{3}{4}$ to $4\frac{1}{2}$ mil. in 22, 80, 81, 85 ;
5 to $6\frac{1}{4}$ „ „ 21, 73, 75, 77 ;
7 to 10 „ „ 7, 16, 23, 61, 74, 79, 94.

A general view of the results is given in Table A. The first column shows the average increase before transplantation. based

on the results of from 4 to 11 years; the second column gives the number of years of depression following transplantation; the third shows the annual average amount of the depression; and the fourth the average rate of increase after recovery.

TABLE A.—GENERAL VIEW OF THE RESULTS OF TRANSPLANTATION ON GIRTH-INCREASE.

No.		Original Average.	Depression. Years.	Depression. Millimetres.	Final Average.	No.		Original Average.	Depression. Years.	Depression. Millimetres.	Final Average.
73	Æsculus Hippocastanum,	20½	1	6¼	29½	80	Æsculus Hippocastanum,	30½	3	4½	20
75	Fraxinus excelsior ..	14½	4	8½	21½	61	Quercus rubra, ..	22½	2	7½	12¾
18	Prunus Padus, ..	20	1	0	27	9	Populus fastigiata, ..	26	5	5	?
21	Cytisus Laburnum, ..	21½	2	5½	25	86	Carpinus Betulus, ..	17	10	5½	?
81	Carpinus Betulus, ..	18	2	4½	20	54	Quercus conferta., ..	13	1	1¼	?
85	Tilia europœa, ..	16½	2	4½	17¾	98	Fagus sylvatica, ..	32¾	?	?	Died.
94	Ulmus montana, ..	36¼	3	10	36	97	,, ,, ..	30½	?	?	,,
77	Pyrus Aucuparia, ..	16	2	5	15½	71	Acer Pseudoplatanus,	30½	1	0	,,
22	Prunus avium, ..	32½	1	3¾	30	76	Populus fastigiata, ..	31	1	0	,,
69	Tilia europœa, ..	21	2	0	19	78	Betula alba, ...	29	3	6½	,,
69	,, ,, 2nd time,	21	1	0	?	23	Fraxinus excelsior, ..	31	4	5½	,,
78	Pyrus Aucuparia, ..	24	2	7½	21½	87	Populus fastigiata, ..	22½	1	0	,,
74	Acer Pseudoplatanus,	37½	4	7	30	88	Alnus glutinosa, ..	19	3	2½	,,
85	Tilia europœa, 2nd time,	17¾	4	5	11	6	Ulmus campestris, ..	10½	2	?	,,

It will be seen that the original average was exceeded by the final average in 6 cases; that these two averages were nearly equal in 5; and that the final fell decidedly below the original in 4.

In general, the appearance of a tree is an index to the degree of its recovery of girth-increase, but not invariably. The American oak, No. 61, is a remarkable exception. The year after transplantation the foliage was very scanty, and next year, in consequence of the death of the young twigs, there was no foliage, but in the following year there was a slight improvement, and in the next the recovery both of foliage and girth-increase was complete.

II.—EFFECTS OF PRUNING.

Nearly all the observations on the effects of pruning were made upon trees in the shelter borders of the Arboretum. As explained in the Introduction, these trees had been on my lists for some years before being pruned, so that their previous rate of increase had been ascertained. In the autumn of 1895 all the trees in these borders were pruned, root and branch, in preparation for transplantation ; but, as it happened, only a few of the twenty on my list were transplanted, and thus an opportunity was afforded of studying the results of pruning in a considerable number of trees not afterwards disturbed, as well as in a few complicated by transplantation. By some mistake two or three of the trees were much over-pruned,* so that the prospects of recovery under such circumstances could also be ascertained.

ACER PSEUDOPLATANUS. No. 16.

In the north border of the Arboretum from the beginning till now. In 1892 it girthed 11½ inches, and in that and the two following years increased at the rate of 31 mil., but in 1895 the increase unaccountably fell to 11½. The amounts fell still further, after pruning, to 3¾ and 1¼, and the average for six years—1896–1901—was only 3¾ ; but in 1902 there was a revival to 16½, and the rate from 1903 to 1906 was 22, which is low for a tree of its species and age. In appearance the tree was always healthy.

ACER CAMPESTRE. No. 12.

Also in the north border from the first. Its girth in 1892 was 13½ inches, and from 1892 to 1894 the average rate of increase was 32½ mil. ; but in spring 1895 it was noticed that the top branches were dead, and the increase in that year fell to 8¼. After pruning next year the increase unexpectedly rose to 25½, and the rate till

*This over-pruning, which I regret to say affected more trees than the two or three mentioned by Dr. Christison, amounted in some cases to mutilation from which recovery was hopeless. The pruning which was necessary in order to obtain shapely trees was entrusted to a forester on the staff whose zeal far outran the discretion which his training had taught him, with most unfortunate consequences to many of the trees with which he dealt at the outset of his operations and until the over-pruning was observed.—Is.B.B.

1899 was 22½. The subsequent very low rate for seven years to 1906 of 8½ is unaccountable, as the tree seems well-clothed and healthy.

ÆSCULUS HIPPOCASTANUM. No. 4.

Always in the west border. Girthed 12¾ inches in 1892 and for four years had a rate of 31 mil. In 1896, after pruning, the increase fell to 19½; and the average, by a steady decline for three years, to 13; and for the next four, to 10. The results for the remaining four years to 1906 were even worse, the figures being 5, 3, 3½, 0. There is nothing in the appearance of the tree to account for this remarkable history, and the removal of surround-trees and bushes seems too slight a reason for so great a decline in the increase.

ALNUS GLUTINOSA. No. 7.

On its original site in the west border. Girthed 8½ inches in 1892 and increased for four years at the rate of 19½ mil. In 1896, after pruning, the increase fell to 7¾ and the average for four years to 4½. In the next five it improved to 9, but in 1905 the increase was only 3½, and in 1906 2½; yet the tree does not seem unhealthy.

BETULA ALBA. No. 17.

Always near the north-east corner of the Arboretum shelter belt. Girthed 13½ inches in 1892 and had the high rate of 41 mil. for four years. After pruning in 1896 the increase was only 12¾, and the rate for four years to 1899 was only 10½. In 1900 it jumped up to 28, but the rate fell again for six years till 1896 to 22, not much above half of that before the pruning.

CRATÆGUS OXYACANTHA. No 11.

In its original site at the north-west corner of the Arboretum shelter belt. Girthed 10 inches in 1892. Dividing the years of observation into three periods of four years each and one of three years, the first gives a rate of 25½ before pruning; the second, 6½ after it; the third, a recovery to 17½; and the last to 24, or nearly the rate before the tree was pruned.

CYTISUS LABURNUM. No. 1.

On its original site in the west border. Girthed 8½ inches in 1892 and increased at the rate of 16½ till pruned in 1896, in which year the increase fell to 7½, and for the eleven years till 1896 the rate has been no more than 8¾, varying between 6½ and 17¾, and showing no sign of improvement latterly.

FAGUS SYLVATICA. No. 20.

Always in the north border till transplanted in 1905 to form part of a new row of beeches near the west border. Girthed 13½ inches in 1892 and increased for three years at the rate of 36½ mil. Pruned in 1896, the increase for that year was 15, and the average for three years 14. In 1899 it revived to 20½, and that rather low rate for a beech of its age was not improved on for five years, when the tree was transplanted.

FRAXINUS EXCELSIOR. No. 2.

In its original position in the west border. Girthed 12 inches in 1892, and the rate for four years to 1896 was 30¾ mil. Pruned in that year, the increase fell to 16½, and the rate till 1896 was only 13½. Neither has there been much improvement since, as for the seven years 1899–1905 the rate was 17, and the increase for 1906 was no more than 14.

POPULUS FASTIGIATA. No. 9.

Stood in the west shelter belt and girthed 8½ inches in 1892, and for four years increased at the rate of 31½ mil. Pruned in the spring of 1896, the rate fell in the following four years to 17¾, but recovered in the next two to 26, when the tree was transplanted to the poplar group.

PRUNUS PADUS. No. 5.

Always close to the Lodge, Arboretum Gate. Girthed 12½ inches in 1892, and in that year had the extraordinary increase of 2 inches—said to be, perhaps, due to its site being on a former midden. The rate continued as high as 45½ mil. till 1896, when, after pruning, the increase fell to 27½ in that year and the rate to 25 for six years. There has been a further decline to 19 in

the last four years, although the tree retains its very healthy, vigorous, spreading appearance.

PYRUS COMMUNIS. No. 8.

Still stands in its original position in the west shelter belt. Girthing 11 inches in 1892, its average rate of increase was $20\frac{1}{4}$ for four years. It was then, by some mistake, pruned to such excess that a perpendicular section of the foliage would have resembled a sharp-pointed spear.

The result on the girth-increase was, of course, disastrous, as shown in the Table, although it is remarkable that there should have been any increase at all at first, with the foliage reduced almost to nil. The decline, however, was steady till zero was recorded in 1899 and $1\frac{1}{4}$ in 1900. Thinking that the tree was dead or dying, I gave up measuring it; but in 1903 it was beginning to form a head of foliage, and a remeasurement in autumn showed an average increase of $3\frac{3}{4}$ for the three years 1901–3, and this has been slightly improved upon since.

Average of Four Years.	1896–1900	Average of Three Years, 1901–1903.	1904–1906
21	$6\frac{1}{4}$ $2\frac{1}{2}$ $1\frac{1}{2}$ 0 $-1\frac{1}{2}$	$3\frac{3}{4}$	4 4·5 5

The tree has now assumed a columnar form, the foliage being nearly equally wide below and above. The stem is 9 feet long and the height of the tree 22 feet, the foliage-spread, or diameter, being only 6 feet. The young branches all tend to grow upwards, resembling a Lombardy poplar. As the foliage is dense and healthy, it will be interesting to see if it will now spread out, and if a tree, which had been so near dying, can eventually thrive. It is well placed, with room to spread, and in autumn 1906 was surface-manured with withered leaves and grass.

QUERCUS CERRIS. No. 15.

Situated always in the north border. Girthed almost 6 inches in 1892, and for four years had the rate of 17 mil. After pruning, it dropped for three years to $14\frac{1}{2}$, but rose for the next five to $19\frac{1}{2}$, and for the final three years to 1906 it has been 18.

QUERCUS CONFERTA. No. 40.

Situated to the east of the Rockery in the Botanic Garden. Girthed 23½ inches in 1878, and for six years increased at the rate of 44 mil. In two quinquennial periods—from 1884 to 1893—it was 39 and 37. After pruning in 1894 the increase in that year fell to 22, and the quinquennial rate to 1898 was 17, and to 1903, 14; while it fell off still further—to 11½—for the period 1904–1906. This progressive falling off through the whole period of 29 years was, probably, mainly the natural result of increasing age, but accelerated by the pruning in 1894.

QUERCUS CONFERTA. No. 54.

Girthed 16½ inches in 1880. Unlike No. 40, the progress in this younger oak was upwards at first in three periods of from four to six years, the rates being 41, 43, and 47 mil. Pruning in 1894 reduced the amount in that year to 27, and the rate for eight years was only 18. An alarming and unaccountable progressive decline to 7½, 6½, and 4 followed in 1903–4–5, when the tree was transplanted.

QUERCUS CONFERTA. No. 55.

Girthed 13½ inches in 1880, and the rates for the three periods corresponding to those of No. 54 were 40, 38, and 43 mil. After pruning in 1894 the increase fell to 19, and the rate for five years to 16½. In one of these—1897—the increase was only 1¼; in the next three years—1899–1901—the rate revived to 24; but relapsed again to 14 for four years to 1905. The increase of 27 in 1906, however, is encouraging. Like Nos. 40 and 54, this tree has always looked well, but in none of them has the pruning produced a vigorous upward growth as yet.

QUERCUS PEDUNCULATA. No. 2.

Situated near the ruined walnut, Arboretum entrance. Girthed 8 inches in 1888, and for three years its rate of increases was 9 mil. Infancy seemed then to be passed, as the rate for the next three years was 22, but it fell back to 12 in 1894–95. The tree was then pruned and the increases for the next three years were only 1¼, 2½, and 3¾. A revival to 12¾ took place in the following

year—1899—and this rate was maintained for three years ; but a depression followed in 1902 and 1903 to 5 and $2\frac{1}{2}$, which I can only account for by disturbance from the removal of neighbouring trees and shrubs. Since then—from 1904 to 1906—there has been a progressive improvement to $9\frac{1}{2}$, 13, and $15\frac{1}{2}$.

QUERCUS PEDUNCULATA. No. 10.

Always in the west border. Girthed $11\frac{1}{2}$ inches in 1893. For two years the rate was $17\frac{3}{4}$ mil., but in the next—1895—the increase was only 9. After pruning in 1896 it fell to 5, and the rate for eight years was only $6\frac{1}{2}$. Finally, in the three years 1904–5–6, it has only improved to 10.

QUERCUS ILEX. No. 16.

In the Quercetum. Girthed 4 inches in 1887 and increased at the rate of 16 mil. for seven years. Pruning in 1894 brought down the increase of that year to 4, and the rate for five years to 1898 was $7\frac{1}{2}$; in the next five it revived to 11, and in the final three—to 1906—to 18.

ROBINIA PSEUDACACIA. No. 14.

Always in the north border. Girthed $6\frac{1}{2}$ inches in 1892 and increased at the rate of $22\frac{3}{4}$ mil. for four years. It was only slightly pruned in 1896, and the general rate, which at that age would naturally be upwards, seemed but little affected, as for the next five years it was $26\frac{1}{4}$; as, however, the amount of increase in 1895—the year before pruning—was $35\frac{1}{4}$, and in 1896—after the pruning—only $26\frac{1}{4}$, the difference, 9 mil., may represent the effect of the operation.

TILIA EUROPŒA. No. 3.

Always in the west border, near the Arboretum Lodge. Girthed 14 inches in 1892 and had the satisfactory rate of $31\frac{1}{2}$ mil. for five years. After pruning, the rate fell for three years to 12 ; rallied for 2 to 18 ; fell for 2 to $11\frac{1}{2}$; and for the final three—to 1906—the increases were very irregular—23, $6\frac{1}{2}$, and 12.

TILIA EUROPŒA. No. 85.

In the south border. Girthed 9 inches in 1887, and for the two quinquennia before pruning the rate of increase was only $13\frac{1}{4}$ and $16\frac{1}{2}$. In 1897, the second year after the pruning, the increase was only $1\frac{1}{4}$; but next year it recovered to $16\frac{1}{2}$. The tree was then transplanted in March, 1899, and, after recovery, was retransplanted in spring, 1902. The rate continues very low, but the tree is healthy and well clothed.

ULMUS CAMPESTRIS. No. 6.

In the west border. Girthed $9\frac{1}{2}$ inches in 1892 and had a rate of $15\frac{1}{4}$ increase for four years. After pruning, the rate for three years was only 7. Transplanted in 1899, the tree died and was cut down in 1900.

ULMUS MONTANA. No. 21.

In the north border. Was a fine, handsome tree, 24 inches in girth, when far too severely pruned in 1896. The increases for the four years—1896–99—were only 6, $2\frac{1}{2}$, 4, $1\frac{1}{4}$, and the average for the next five years was 4. The severe pruning left the tree at first almost without a head of foliage, but it gradually began to form, and the increases for the two years 1905–06 have improved to 8 and $14\frac{1}{2}$.

In appearance the tree suffers from the loss of its top-shoot branch, which had to be cut away low down. Thus the foliage at the top is flat, and its general form is cylindrical, equally wide below and above, the diameter of the foliage being 15 feet. The tree is about 20 feet high and the cylindrical mass of foliage begins at 5 feet, where the first branch is given off.

REMARKS.

The chief events in the history of the twenty-three trees subjected to pruning are put together in Table B. The results are historical in regard to the trees individually, rather than comparative between one tree and another, because the degree of pruning to which they were subjected varied much, and cannot be systematised.

The facts are given in the Table in the following order :—

1. The average rate of increase before pruning.
2. The average rate for the whole period after it.
3. The highest record in any one year.
4. The lowest record in any one year.
5. The average rate for the last two or three years.
6. The lapse of years between the pruning and the final results.

TABLE B.—EFFECTS OF PRUNING ON THE RATE OF GIRTH-INCREASE, IN THE ORDER OF THE LEAST EFFECT.

No.		Rates.		Highest in any year.	Lowest in any year.	Average of 2 or 3 last years.	Lapse of years.
		Before Pruning.	Whole period after it.				
14	Robinia Pseudacacia, ..	22¼	23¼	29¼	20½	23½	11
16	Quercus Ilex, ...	16	12¼	21½	9	20	13
15	,, Cerris, ...	17	17¼	21½	12¾	18	11
85	Tilia europœa, ...	16½	11¾	16½	1½	16½*	3
11	Cratœgus Oxyacantha, ..	25½	15½	26	5	25¾	11
9	Populus fastigiata, ..	31	20¼	26½	15¼	26¾	7
55	Quercus conferta, ..	43	17	28	1¼	27	11
16	Acer Pseudoplatanus, ..	31	10¼	27½	1¼	19	11
20	Fagus sylvatica, ...	36	19	25½	12¾	19¾	10
17	Betula alba, ...	41	17¾	29½	6½	19½	11
10	Quercus pedunculata, ..	17¾	7	10½	5	9	11
1	Cytisus Laburnum, ..	16½	10¼	27	6½	7¼	11
6	Ulmus campestris, ..	15½	7	10	5	6	3
2	Fraxinus excelsior, ..	30¾	16¾	20¼	11½	11	11
8	Pyrus communis, ...	20¼	3½	10	0	7½	11
5	Prunus Padus, ...	50¾	22¼	28	15	16	11
21	Ulmus montana, ...	35	5	14½	1½	11½	11
3	Tilia europœa, ...	31	14	23	6½	9	11
40	Quercus conferta, ...	39	12	20¼	2½	11	11
12	Acer campestre, ...	32½	15½	25½	1¼	11½	11
54	Quercus conferta, ..	47	12½	20½	0	7	9
7	Alnus glutinosa, ...	19½	6	10	2½	3	11
4	Æsculus Hippocastanum,	31	8	19	0	2	11

* Last year only.

Taking the rate for the last two or three years as the criterion of recovery, the most obvious fact is that only five of the trees have recovered their original rate before pruning, and only one of them, the evergreen oak, has exceeded it by an appreciable amount. Six have recovered about half their original rate; four rather above a third of it; four rather under a third; while in two the recovery is only to about a sixth, and in one to a sixteenth.

The question what practical lessons, if any, can be deduced from the tabulated results is not easy to determine. Do they show that the trees generally were over-pruned? At first sight it would seem so, from the great diminution in the girth-increase of the stems; but if the object desired—the promotion of growth upwards—was obtained, this sacrifice of girth increase may have been natural and proper. To me, however, it seems that this object was not fully obtained, because, in most instances, the stems above the bole appear to taper too suddenly upwards. But I have no experience to guide me in forming a definite opinion.

One conclusion is clear, that the pruning carried out in 1896 has been followed, in the majority of instances, by a serious falling-off in the girth-increase in the stems for at least eleven years. It has also been proved that a tree so over-pruned as to have its head of foliage reduced to a "spear-point," and its girth-increase reduced for several years almost to nil, may gradually recover and give promise of becoming eventually a handsome specimen.

Gentianaceæ from Eastern Tibet and South-West China.

BY

GEORGE FORREST.

With Plates XII.-XIX.

Having gone to China in 1904 as Collector for Mr. A. K. Bulley of Ness, Neston, Cheshire, in the course of my travels during the past three years amongst the mountain ranges on and within the south-eastern tibetan frontier, I have sent to the Herbarium of the Royal Botanic Garden from time to time specimens of plants; the flora and these, along with a number I brought with me on my return to Britain, form a large collection of dried plants, accompanied by notes of locality, elevation, and features of the plant as seen by me growing.

Much of the country has not been explored botanically hitherto, and therefore the collection contains many novelties and interesting forms. The following is a list of the Gentianaceæ; in subsequent numbers of these "Notes" lists of plants of other families will appear.

I have to express my indebtedness to Professor Bayley Balfour for his assistance in the determination of my collections.

GENTIANA.

Gentiana (Amarella) Trailliana, G. Forrest. Sp. nov.
Plate xii.

Annua 2·5 dm. alta glabra erecta a basi ramosa, caule quadrangulari purpurascente ramis ascendentibus unifloris vel 2-3-floris. Folia basalia ovata obtusa in vaginam attenuata, maxima 1·5 cm. longa, 8 mm. lata; folia superiora ovata amplexicaulia (jugis ad 8). Flores longe-pedicellati, pedunclis sæpe 5 cm. longis rigidis. Calyx laxus basi tantum gamosepalus, lobis 5 parum inæqualibus

lanceolatis v. ovatis 8 mm. longis. Corolla cærulea hypocrateriformis ad medium 5-loba, tubo 12 mm. longo cylindrico intus basi glanduloso, lobis ellipticis integris obtusis, squamis 4 mm. longis multifidis albidis. Stamina ad medium tubi affixa squamas attingentia. Gynæceum 12 mm. longum, ovario oblongo vix stipitato, stylo brevi lobis recurvis.

"Dry pasture land, Chung Tien plateau opposite Niu Chang pass and near Hsia Chung Tien. Flowers blue. Elevation 12–13,000 feet. Yunnan, Sept. 1904." G. Forrest. No. 350.

A distinct species allied to Franchet's *G. cyananthiflora* which is distinguished by its perennation, its caudicles, the long petioles to its basal leaves, and its smaller flowers.

Gentiana (Pneumonanthe) rigescens, Franchet, in Journ. Linn. Soc., xxvi. (1890), p. 134; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 251.

"Plant of 6–18 inches. Flower rich violet purple. On open downs around Teng Yueh. Lat. 25° N. Alt. 6–8,000 feet. West Yunnan, Nov. 1905." G. Forrest. No. 1048.

The dark red, almost black, colour of many of the stems is a prominent feature.

Gentiana (Crossopetalum) detonsa, Rottb. (1770); Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 127.

"Barren hillsides in the valley of the Tang Tui between Chung Tien and Chiao Tau. Elevation 11,000 feet. Flowers bright blue. Yunnan, Sept. 1904." G. Forrest. No. 49.

"Rocky hillside on descent from Chung Tien plateau to valley of Yangtse near Tang Tui. Flowers blue. Elevation 10,000 feet. Yunnan, Sept. 1904." G. Forrest. No. 120.

"Damp gravelly ground south end of Lang Kung valley. Alt. 6–7,000 feet. Yunnan, 1904." G. Forrest. No. 250.

"Dry gravel beds on side of stream running through Teng Chuan valley. Elevation 8000 feet. Plant of 6 inches to 1 foot. Flowers deep blue. Yunnan, Oct. 1904." G. Forrest. No. 403.

Gentiana (Stenogyne) rhodantha, Franchet, in Journ. Linn. Soc., xxvi. (1890), p. 133; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 251.

"Wei Hsi valley, at an elevation of 9000 feet. Edges of dry pine-woods and like situations. Flowers pink. Yunnan, Oct. 1904." G. Forrest. No. 23.

"Dry banks and on edges of pine-woods, valley of Wei Hsi. Alt. 9–10,000 feet. Yunnan, 1904." G. Forrest. No. 414.

Gentiana (Stenogyne) Serra, Franchet, in Bull. Soc. Bot., France, xxxi. (1884), p. 376; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 252.

"On grassland, head of Chien Chuan valley. Alt. 8000 feet. Yunnan, 1904." G. Forrest. No. 301.

Gentiana (Stenogyne) leptoclada, Balf. fil. et G. Forrest. Sp. nov. Plate xiv.

Annua radice tenui glaberrima e basi multicaulis, caulibus patentibus tenuibus viridibus 4-angulatis alis integris, ramis ultimis horizontaliter divaricatis. Folia rosularum sub anthesi nulla; caulinia parva late ovata v. subcordiformia brevissime petiolata tenuia 5-nervia, 1–1·5 cm. longa, 7–10 mm. lata, margine tenuiter erosa subcartilaginea. Flores solitarii ad apicem ramulorum brevium inter folia suprema brevissime pedicellati. Calycis tubus membranaceus angustus obconicus 8 mm. longus, angulis quinque exalatis viridibus v. nigro-rufescentibus minutissime scaberulis; lobi lineari-aristati 4 mm. longi. Corolla cœrulea calyce fere triplo-longior obconico-tubulosa, tubo 2 cm. longo, lobis triangulari-acutis latis 7 mm. longis plicas subtruncatas breviter fimbriatas super-antibus. Staminum filamenta apice recurva. Ovarium angustum 10 mm. longum stipitatum, stipite 5 mm. longo basi aurantiaco tumido; stylus ovarium æquans corollam superans ramis brevibus recurvis. Semina complanata exalata.

"Valley of the Yangtse above Shiti Ko 7–9000 feet. Flowers bright blue. Yunnan, Oct. 1904." G. Forrest. No. 409.

Allied to *G. primulæflora*, Franchet, but distinguished by its larger size, larger flowers, shape of the corolla. In some flowers two of the stamens are much shorter than the others, but this does not appear to be a constant feature.

Gentiana (Frigida) ornata, Wall. (1828); Kusnezow, in Acta Horti Petropol., xv. (1898), p. 268.

"Boggy ground. Summit of Nie Chang pass between River Yangtse and Chung Tien plateau. Elevation 14–15,000 feet. Flower deep blue. Yunnan, Sept. 1904." G. Forrest. No. 408.

Var. **alba**.

A plant that appears to be a white variety of this species is included in the collection from

"Plateau on summit of pass between Wei Hsi and Chi Tien on the Yangtse. Yangtse-Mekong divide. Elevation 14,000 feet. Flowers pierce snow, white. Yunnan, Oct. 1904." G. Forrest. No. 408.

Gentiana (Frigida) heptaphylla, Balf. fil. et G. Forrest.
Sp. nov. Plate xiii.

Perennis cæspitosa e collo multicaulis, sub anthesi plurimis gemmibis suffulta, caulibus tomentosis decumbentibus demum erectis unifloris. Folia rosulata nulla ; caulinia semper 7-verticellata in vaginam unam plus minusve membranaceam coalita ; laminæ verticillarum inferiorum ovatae v. obovatae 4-5 mm. longæ 2 mm. latæ vaginaque commune 2 mm. longa laminis continua, superiorum subflorem congestarum lineares 12 mm. longæ 2 mm. latæ vagina 8 mm. longa sinubus concavis, omnes acutæ margine minute albo-ciliatæ. Flores sessiles. Calyx foliorum verticilli verosimilitudine 7-lobus, lobis 8 mm. longis, viridibus linearibus acutis, tubo 13 mm. longo 7-purpureo-vittato paullo brevioribus. Corolla magna, 4.5 cm. longa late campanulato-infundibuliformis cœrulescens punctata et 7 fasciis coloratis cœruleo-vittata 7-loba, lobis brevibus 5 mm. longis deltoideis integris acuminatis, plicis truncato-erosis. Ovarium valide stipitatum, stylo brevissimo.

"Bare grassland on western side of summit of Kari pass, also for some distance on descent to Shu Pa Lung valley. Yangtse-Mekong divide. Elevation 15–16,000 feet. Yunnan, Sept. 1904." G. Forrest. No. 45.

"Kari pass. Near summit between Pung-tzu-la and Shi-zo. Yangtse-Mekong divide. Dry grassland. Yunnan. Elevation 15,000 feet. Sept. 1904." G. Forrest. No. 405.

A near ally of Franchet's *G. ternifolia* and of the *G. hexaphylla* of Maximowicz, but distinguished at once by the leaves, seven in a whorl. A beautiful plant.

Gentiana (Frigida) cephalantha, Franchet, in Journ. Linn. Soc., xxvi. (1890), p. 125; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 274.

"Descent from pass between Wei Hsi and the Yangtse. Yangtse-Mekong divide. In dry pine-woods at 10–11,000 feet. Flowers blue. Yunnan, Oct. 1904." G. Forrest. No. 28.

Apparently this species, but in the absence of fruit and seed the determination is not quite certain. The specimens show a much greater variation in the lobing of the calyx than is given under the specific description.

Gentiana (Frigida) sikkimensis, Clarke (1883); Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 135; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 276.

"Eastern slope of pass between Shih Pa and Yeh Chih. Yangtse-Mekong divide, between Shu-pa valley and Mekong. In moist pine-woods at an elevation of 15,000 feet. Flowers blue. Yunnan, Sept. 1904." G. Forrest. No. 55.

Gentiana (Frigida) microdonta, Franchet, in Journ. Linn. Soc., xxvi. (1890), p. 130; Kusnezow, in Acta Horti Petropol., xv. (1890), p. 272.

"Abundant on Nie Chang pass, boggy ground in pine-woods. Height 1 to 2 feet. Flowers bright blue. Elevation 12–14,000 feet. Yunnan, Sept. 1904." G. Forrest. No. 410.

This is not quite Franchet's species. Its flowers are longer and larger. From *G. trichotoma* of Kusnezow it differs in the want of elongated inflorescence axes, and particularly in the construction of the calyx.

Gentiana (Frigida) picta, Franchet in Journ. Linn. Soc., xxvi. (1890), p. 131; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 285.

"Marshy ground sides of streams and bogs head of Lang Kung valley and on divide between that and Chien Chuan valley. Alt. 7–9000 feet. Yunnan, 1904." G. Forrest. No. 354.

"Grassy plateau on divide between Chien Chuan and Teng Chuan valleys. Elevation 9000 feet. Yunnan, Oct. 1904." G. Forrest. No. 413.

All my plants are pentamerous.

Gentiana (Frigida) Duclouxii, Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 305.

"Generally prostrate. In shady thickets on hills N.-W. of Yunnanfu Lake. Elevation 7000 feet. Yunnan, S.-W. China, February 1905." G. Forrest. No. 470.

Gentiana (Frigida) yunnanensis, Franchet, in Bull. Soc. Bot., France, xxxi. (1884), p. 376; Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 138; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 285.

"On the descent to the Chung Tien plateau from Niu Chang Pass. Elevation 12,600–14,000 feet. More often in cultivated places than others. Flowers white. Yunnan, 1904." G. Forrest. No. 407.

Seems to be a variable plant in its flowers, particularly in the calyx.

Another specimen—"Chung Tien plateau. Elevation, 12–13,000 feet. Dry pasture land. Flowers blue. Yunnan, Sept. 1904." G. Forrest. No. 30,—seems to be the same as Pratt's No. 470 from Yunnan and may be a form of this species.

Gentiana (Frigida) phyllocalyx, Clarke (1883); Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 131; Kusnezow, in Acta Horti Petropol., xv. (1898), p. 288.

"Barren grassland edge of cane-brakes near summit of Kari pass. Alt. 15,000 feet. Tibet, 1904." G. Forrest. No. 401.

"Mekong-Salwen divide behind Tzekou Mission. Tibet, 1904." G. Forrest. No. 402.

Gentiana (Isomeria) Delavayi, Franchet, in Bull. Soc. Bot., France, xxxi. (1884), p. 377; Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 126; Kusnezow, in Acta Horti Petropol., xv. (1904), p. 343.

"Dry stony hillsides, Chien Chuan valley. Alt. 8–9000 feet. Yunnan, 1904." G. Forrest. No. 309.

Gentiana (Chondrophylla) scariosa, Balf. fil. et G. Forrest. Sp. nov. Plate xv.

Annua glauca pumila gracilis, 5–6 cm. alta, caulibus a basi ramosissimis ramis erecto-fasciculatis dense imbricato-foliatis. Folia rosulata brevia 5–7 mm. longa, oblonga acuminata rigida margine hyalina; caulinia 1–5 cm. longa basi connata adpresso-erecta subulata plus minusve scaberula trinervia nervo medio subtus prominulo, margine late membranaceo, apice triquetro aristulato; folia superiora calycis basim involucrantia. Flores solitarii sessiles. Calyx 2 cm. longus corolla brevior, lobis erectis 8 mm. longis binerviis acuminatis aristulatis tubo paullo breviori-

bus. Corolla tubulosa cœrulescens punctulata, 3 cm. longa, lobis ovatis acutis apiculatis 5 mm. longis margine subundulatis, plicis ovatis cœruleis erosis lobis fere æquilongis. Ovarium longe stipitatum.

"Descent from Niu Chang Pass to Chung Tien Plateau. Elevation, 13–14,000 feet. Open grassy places in pine-woods. Flowers, bright blue, closing whenever the plant is plucked. Yunnan, Sept. 1904." G. Forrest. No. 404.

A near ally of *G. Rockhilli*, Hemsl., but more branched, has longer leaves, is scaberulous, has a longer corolla with slightly crenate apiculate lobes, and the plicæ are blue.

Gentiana (Chondrophylla) taliense, Balf. fil. et G. Forrest. Sp. nov.

Annua 4 cm. alta, a basi dense breviterque ramosa, caulibus minutissime scabriusculis. Folia basalia majora oblonga elongata ad 3·5 cm., 13 mm. lata. subcrassa, superiora elliptica, suprema anguste lanceolata, omnia plus minusve albomarginata carinataque, margine minutissime scaberula, apice recurvata aristata. Flores brevissime pedicellati. Calyx tubum corollæ superans, tubo membranaceo campanulato exalato 3 cm. longo, lobis lanceolatis 4 cm longis carinatis margine membranaceis apice aristatis. Corolla tubulosa alba v. cœrulea ad staminum insertionem aurantiaca, tubo 8 mm. longo, lobis rotundato-triangularibus mucronulatis vix 2 mm. longis, plicis vix lobis brevioribus subtruncatis crenulato-erosis. Stamina æqualia filamentis basi incrassatis. Ovarium complanatum 4 mm. longum 2·5 mm. latum cum stipite 1·5 mm. longo discoque 5-gono cincto, anguste alatum, apice rotundatum ibique ala quaque in duas alas minute dentatas fissa; stylo breve ad basin usque bifido ramis revolutis. Capsula vix exserta ala apice incrassata; semina fusiformia trigona, testa obscure areolata cellulis in longum extensis.

"On grassy slopes around Tali. Abundant on interior of city walls. Flowers ranging from white to deep blue, centre orange yellow. Elevation 6500–8000 feet. Yunnan, S.-W. China." February 1905. No. 702.

A species of the affinity of *G. pedicellata*, Wall., of which the limits are variously drawn by authors. It may be that the plant here described is a particularly xerophilous form of it, but none of the descriptions of forms of *G. pedicellata*, nor specimens quite match it.

Gentiana (Chondrophylla) albescens, Franchet, in Herb. Petropol., ex. Kusnezow, in Acta Horti Petropol., xv. (1904), p. 409. *G. argentea*, Royle, var. *albescens*, Franchet, in Journ. Linn. Soc., xxvi. (1890), p. 124.

"Dry rocky ground Chien Chuan valley. Alt. 9-10,000 feet. Yunnan, 1904." G. Forrest. No. 406.

Franchet places this plant as a variety of *G. argentea*, Royle, in his diagnoses incorporated by Forbes and Hemsley in the Journal of the Linnean Society, and with that species it is no doubt closely allied, if distinct. My plant is slightly different from the *albescens* of Franchet. Its stem below the leaves is densely pilose; the cauline leaves are all ovate; the calyx lobes are equal in length to the calyx tube; the corolline plicæ are nearly equal in length to the corolline lobes and are crenate with a slightly bifid apex.

Gentiana (Chondrophylla) Clarkei, Kusnezow, in Acta Horti Petropol., xv. (1904), p. 419.

One flowering stem, but without locality, of what appears to be this minute species is in the collection. No. 1,129.

Gentiana (Megacodon) venosa, Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 137.

"Mekong-Salwen divide behind Tzekou Mission. Elevation—. Tibet, 1904. G. Forrest. No. 412. Incomplete specimen. Growing also on summit of Nie Chang Pass between Ke-Lo-Wan on Yangtse and Chung-Tien plateau. Elevation 15,000 feet. Very boggy ground in and on edges of pine-woods. Stem leafy. Radical leaves same as those on stem. Plant from 2–4 feet, flowering July and August. Yunnan, Sept. 1904."

CRAWFURDIA.

Crawfurdia Trailliana, G. Forrest. Sp. nov. Plate xvi.

Planta scandens omino glabra 20-pedalis. Caulis volubilis quadrangularis sæpe purpurascens. Folia breviter petiolata petiolo 5–8 mm. longo subalato; lamina 5–7 cm. longa 2–3 cm. lata oblonga v. elliptica, plus minusve acuminata, basi angustata, crassa, subtus pallidior, trinervius, margine integra v. sub-erosa, subrevoluta subcartilaginea. Rami florales ad axillas foliorum solitarii binive rarissime terni, superpositi et acropetentim evoluti, florem unum gerentes ad apicem pedunculi longi subquad-

rangularis volubilis basi pari foliolorum linearium minutorum sterilium vestiti, vel cymam volubilem formantes internodiis elongatis vestitamque 3–4 paribus foliorum linearium plus minusve fertilium. Flores magni pentameri pedunculis elongatis. Calyx tubulosus purpurascens, tubo 2 cm. longo per anthesin dimidiato-spathaceo 5-carinato brevissime coronato, corona integra lobis 2 mm. longis deltoideis acutis recurvis subcrassis trinerviis. Corolla 7 cm. longa colore heliotropii supra late campanulata infra tubulosa tubo ex ore calycis triente protracto intusque per totum staminum filamentis bialatis alligatis munito; lobis 15–16 mm. longis, 12 mm. latis triangulari-ovatis acutis, margine subcrenulato, trinerviis, plicis brevibus crenulatis. Staminum filamenta 2 mm. lata ex fauce libera complanata nerve medio conspicuo; antheris versatilibus. Discus 5-glandulosus. Ovarium stipite subnullo; stylus infra ramos 12 mm. longos 2·5 cm. longus.

"Climber of 6–20 feet. Flowers rich deep heliotrope. Damp shady situation on tall grass and scrub. Side valleys of the Salwen, Salwen-Irrawaddi divide, from Shah-Pai-Lei-Ti north to Me-Ko-Ti. Lat. 26° 10′ to nearly 27° N. Alt. 5–7000 feet. Forms a distinct belt never above nor below those heights. N.-W. Yunnan, Nov. 1905." G. Forrest. No. 963.

A beautiful species showing markedly the twining character in the flower-stalks as well as in the vegetative stem. Accessory flower-shoots are developed regularly and acropetally in the axils of the leaves. The first axillary shoot developed forms commonly an elongated cyme, ending in a flower and bearing three or four pair of leaves below, all or some only of which give rise to flowers. The accessory shoot may do likewise or form only a single terminal flower the peduncle of which shows only a pair, occasionally two pairs, of small leaflets at its base. Towards the termination of the vegetative twigs the elongated cymes may not develope and the accessory buds may remain arrested. The length of the flower peduncle varies, a terminal flower of a cyme may have one several inches long. The ovary has hardly any stipe, and as it enlarges it causes rupture of the calyx dimidiately along one side in the same fashion as Franchet describes it in *C. Delavayi*. From that species *C. Trailliana* is at once distinguished by its large flowers.

Crawfurdia Bulleyana, G. Forrest. Sp. nov. Plate xvii.

Planta scandens 10–20 pedalis. Caulis volubilis quadrangularis angulis sæpe purpurascentibus. Folia petiolata, petiolo tenui 2 cm. longo; lamina 6–7 cm. longa, 3·5–4 cm. lata, cordiformis

v. late ovata, basi late cuneata v. subtruncata, apice subacuminata, 5–7 nervia subtus pallidior margine vix cartilaginea et sub-erosa. Rami florales volubiles ad axillas foliorum bini superpositi, ramo axillari inferiore unifloro, superiore laxe cymoso bracteis foliis conformibus. Flores magni pentameri pedunculis volubilibus. Calyx infra tubulosus, tubo non fisso 17 mm. longo submembranaceo 5-alato brevissime coronato corona integra purpurascente, supra cupulato-explanatus foliaceus cupulo 8 mm. longo lobisque 4 mm. longis ovatis erectis acutis uninerviis reticulatis margine sub-erosis. Corolla cœruleo-purpurea striis magis intense coloratis notata 6 cm. longa supra late campanulata infra obconico-tubulosa, tubo ex ore calycis breviter extenso intus staminum filamentis bialatis alligatis munito; lobis 8 mm. longis triangulari-deltoideis acutis margine integris, plicis rotundatis crenulatis brevibus. Staminum filamenta 5 mm. lata complanata inclusa. Dicsus 5-glandulosus. Ovarium longe stipitatum; stylus infra ramos brevis 5 mm. longus, ramis 4 mm. longis. Capsula exserta fusiformia complanata marginata 3 cm. longa, stipite longiore; semina discoidea late alata 2 mm. diam.

"Climber of 10–20 feet. Flowers bluish purple, markings a deeper shade. In bamboo brakes and on scrub at an elevation of 8–11,000 feet. Ming-Kwong-Irrawaddi divide. Lat. 26° N. Upper Burmah, Oct. 1905. Also on Irrawaddi-Salwen divide above Pien-Ma." G. Forrest. No. 839.

Quite as showy as *C. Trailliana*, from which it is easily distinguished by its cordiform leaves on longer petioles, its smaller flowers with calyx never splitting and bearing foliaceous erect sepal lobes, its capsule with very long stipe and short style.

PLEUROGYNE.

Pleurogyne Forresti, Balf. fil. Sp. nov. Plate xviii.

Annua radice tenui, ad 2·5 dm. alta, omnino glabra, erecta, gracilis, caule obscure quadrangulari a basi vel e medio ramoso. Folia basalia sub anthesi nulla, caulinia elliptica v. sublanceolata v. linearia, vix petiolata, obtusa, subcrassa, margine subcartilaginea. Rami omnes floriferi adscendentes multiflori inflorescentiam copiosam formantes. Flores cœrulei, 5-meri; pedicelli floribus longiores. Calyx ad basin usque partitus, segmentis linearibus 7 mm. longis. Corolla fere ad basin soluta segmentis ellipticis subacuminatis 12 mm. longis; foveolæ duæ prope basin cujusque

segmenti inconspicuæ; squamulæ irregulariter laciniatæ 3 mm. longæ. Stamina ad basin corollæ affixa, æqualia. Capsula oblonga v. subfusiformis 8 mm. longa cum stipite 1·5 mm. longo.

"Summit of pass between Yangtse and Wei Hsi, Yangtse-Mekong divide. Also other places. Elevation 9–11,000 feet. Flowers blue. Yunnan, Oct. 1904." G. Forrest. No. 25.

"Dry open hillside, edge of pine-woods, Lang Kung and other valleys. Alt., 7-9000 feet. Yunnan, 1904." G. Forrest. No. 211.

SWERTIA.

Swertia (Ophelia) purpurascens, Wall., var. **violaceo-cincta,** Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 314.

"Descent from Yangtse divide into Chien-Chuan valley, side of a lake, at an elevation of 10,000 feet. Flowers green, maroon centre. Height 1 to 2 feet. Yunnan, Oct. 1904." G. Forrest. No. 225.

Swertia (Ophelia) nervosa, Wall.; Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 315.

"Chung Tien plateau, open grassy situations. Alt., 12–13,000 feet. N.-W. Yunnan, 1904." G. Forrest. No. 206.

Swertia (Ophelia) cordata, Wall.; C. B. Clarke, in Hook. f. Fl. Brit. Ind., iv. (1883), p. 123.

"Erect plant of 2 to 3 feet. Flowers pale yellowish white. Open places in pine-woods on lava beds in the Ming-Kwong valley, near Machang. Lat. 25°–15° N. Alt. 6500 feet. N.-W. Yunnan, Oct. 1905." G. Forrest. No. 950.

"Plant of 1½ to 2 feet. Flowers white. Moist open situations around Lu-chang, valley of the Salwen, Salwen-Irrawadi divide. Lat. 26° N. Alt. 4 to 5000 feet. N.-W. Yunnan, Nov. 1905." G. Forrest. No. 1103.

Swertia (Ophelia) bimaculata, C. B. Clarke; Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 139; Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 316; Gilg., in Engl. Jahrb., xxix. (1900), p. 539.

"Borders of padi fields in shady places south end of Chien-Chuan valley. Plant of from 2 to 3½ feet. Alt. 8000 feet. Yunnan, 1904." G. Forrest. No. 164.

Swertia (Ophelia) punicea, Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 140; Franchet, in Bull. Soc. Bot., France, xlvi. (1899); p. 317; Gilg., in Engl. Jahrb., xxix. (1900), p. 539.

"Valley of the Mekong at an elevation of 6–9000 feet. Flowers deep purple. Yunnan, Oct. 1904." G. Forrest. No. 27.

Swertia (Ophelia) macrosperma, C. B. Clarke; Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 318; Gilg., in Engl. Jahrb., xxix. (1900), p. 539.

"Dry limestone hillside on ascent of pass between Teng-chuan and Lang Kung valleys. Elevation 8–10,000 feet. Flowers pale blue. Yunnan, Sept. 1904." G. Forrest. No. 76.

Swertia (Ophelia) Delavayi, Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 323.

"Valley of the Yangtse above Shih-ko. Elevation 6–8000 feet. Flowers pale blue. Yunnan, Oct. 1904." G. Forrest. No. 162.

Swertia (Euswertia) mekongensis, Balf. fil. et G. Forrest. Sp. nov. Plate xix.

Perennis sicco nigrescente rhizomate lignoso, caulibus turionum terminalium 2–3 dm. alt. glabris crassis quadrangularibus infra kataphylla 2–3 gerentibus dein nudis supra foliaceis. Folia kataphyllaria amplexicaulia suprema in laminam ellipticam producta; caulinia opposita sessilia ovato-cordiformia acuta plurinervia maxima 5·5-7 cm. longa, 4 cm. lata, integra. Inflorescentiæ in cymas paniculatas breves aggregatæ in axillis foliorum superiorum ommnium. Flores parvi hermaphr oditi tetrameri. Calyx parvus basin corollæ adhærens, tubo 1 mm. longo, lobis triangularibus 2 mm. longis. Corolla rotata, tubo 4 mm. longo, lobis ellipticis violaceo-striatis apice rotundatis minutissime crenulatis 5 mm. longis 4 mm. latis quoque macula biloba basali in faucem projecta instructo. Stamina corollæ lobis breviora et in faucem inserta. Gynæceum breve 4 mm. longum; stylo ad basin usque fisso lobis 2 mm. longis.

"Mekong-Salwen divide behind Tzekou Mission. Tibet, 1904." G. Forrest. No. 230.

A species named *S. congestiflora* by Franchet in the Paris Herbarium seems near this, but I have found no description of it.

HALENIA.

Halenia elliptica, D. Don; Forbes and Hemsley, in Journ. Linn. Soc., xxvi. (1890), p. 141; Franchet, in Bull. Soc. Bot., France, xlvi. (1899), p. 323; Gilg., in Engl. Jahrb., xxix. (1900), p. 539.

"Mekong-Salwen divide behind Tzekou Mission. Tibet, 1904." G. Forrest. No. 163.

"Erect branched plant of 1–3 feet. Flowers deep blue. Open moist bracken-covered situations on the descent from the Irrawaddi Ming-Kwong divide. Alt. 9–10,500 feet. Lat. 25°–50° N. Irrawaddi basin. Upper Burmah, Oct. 1905." G. Forrest. No. 972.

Var. **grandiflora**, Hemsl., l.c.; Gilg., l.c.

"Common in all the valleys north of Tali at an elevation of 7–12,000 feet. Flowers blue. Yunnan, Sept. 1904." G. Forrest. No. 325.

"Pass between Lang-Kung and Sung-Kwei valleys. Open grass-land. Alt. 11,000 feet. Yunnan, 1904." G. Forrest. No. 326.

Dr. paludosa Chang
Xieu plateau opposite
Xieu chang pass and
near Hsia Chang Xieu
flowers blue
elevation 12 to 13000 ft
Yunnan sept 21,
— Ivv.

F. 350

Gentiana (Crossostemma)
Forrestiana Fletcher.

Notes R.B.G. Edin.

Plate XIV

Gentiana (Stenogyne)
Ceylaniea. Griff. Jl. et Ics

2 409

Valley of the Yang
about 7 thick Ro
elevation 7 to 8 000

Notes R.B.G. Edin.

Plate XV

Gentiana (Chondrophylla)
Clariosa Bell. Sil.

Notes R.B.G. Edin.

Plate XVI

PLANTS OF E. TIBET AND S.W. CHINA.

COLLECTED BY GEORGE FORREST

COLLECTOR FOR A. K. BULLEY of MESS, NEBTON, CHESHIRE

Crawfurdia trifliana, G. Forrest.

F. 963

Climber 4-6-20 ft. Flowers rich deep heliotrope, damp shady situations on tall grass, and scrub, side valleys of the Salween, Salween - mountain divide from 10th Pass to 12 North to 11th to 1st Cat. 26 10° 6' nearly 27 1 all 3 1900 ft. Common Natural Cell never above nor below these heights 2.10 Yunnan Nov 1903 (3 sheets)

F. 963

Notes R.B.G. Edin.

Plate XVII.

PLANTS OF E. TIBET AND S.W. CHINA.

COLLECTED BY GEORGE FORREST

A. K. BULLEY, F.L.S. NESTON, CHESHIRE

Cremanthodium sp. aff. Forrest.
7.839.

climber 7-10-20 ft. Flower pale bluish purple markings a deeper shade In bamboo brakes and on scrub, at an elevation of 8-11 000 ft. Mung Kwong - Irrawaddi divide, Lat 26° N Upper Burmah. Oct. 1905. 7.839
(2 sheets)

Also on Irrawaddi - Salween divide

Notes R.B.G. Edin.

Plate XVIII

PLANTS OF E. TIBET AND S.W. CHINA.

...E FORREST

...NESTON, CHESHIRE

Primula Forrestii Hemsl

Notes R.B.G. Edin.

Plate XIX

Sweertia perkonyensis
Ruff. Pl. et Sp. Mon.

No. 230 Mrs. Duncan Cheesman

x6

On the Distribution, Structure, and Function of the Tentacles of Roridula.

BY

A. NINIAN BRUCE, B.Sc.

With Plates XX.-XXI.

The genus *Roridula*[1] is usually included in the family of the Droseraceæ, although doubts are now prevalent as to its right to this position. It is confined to South Africa. It includes two species of small shrubby plants, *R. Gorgonias*, Planch., and *R. dentata*, Linn. These resemble each other closely in outward appearance, particularly in the possession of numerous tentacles distributed over their leaves and stem. The arrangement, structure, and function of these tentacles has not been as yet fully investigated, and the following brief account of them is the result of the examination of (and experiments upon) living plants grown in the Royal Botanic Garden, Edinburgh, and of material preserved from these.

Leaf of Roridula gorgonias.

The leaves of *Roridula Gorgonias* are closely set along the stem.

The leaf is long and narrow; its maximum length about 6 cm., its greatest width, just above the base, is about ·25 cm. This width remains fairly constant through about the lower third above which the leaf begins to taper to the apex, where it ends in a single large tentacle. In its lower part dorsiventral it becomes radial and quite cylindric before it passes imperceptibly into the tentacle (Fig. 1). The surface is covered by numerous

[1] From *ros*, *roris*, dew, after the glistening drops of secretion found on the ends of the tentacles.

stalked glands or tentacles, which vary in length from small ones which require the aid of a lens to be distinctly seen, to large ones about 3·5 mm. in length. For a short distance behind the leaf-apex, the tentacles do not show any very definite arrangement, but occur at irregular intervals all round the leaf (Fig. 2). Behind this, however, the tentacles are restricted to two definite areas—the under side of the leaf along the mid-rib, and the margin of the leaf.

The tentacles arise in greatest number either on or near the margin of the leaf. Tentacles showing all the variations in size mentioned above occur over this area, but the taller ones form four well-marked rows—two along each margin, one row along its upper, and the other along its lower edge (Fig. 3).

There is an alternation in size between the tentacles in each of these rows; between each pair of taller ones there is an intercalated one (or it may be two) of about one-third less length, and between these in turn is a variable number (six to eight) of still smaller ones. These smaller tentacles occur also on the margin of the leaf between the rows of longer ones, but they never appear on the upper or lower surfaces of the leaf; they are much more numerous than the taller ones, and are fairly evenly distributed over the specified area in the lower two-thirds of the leaf, but above this they diminish in number, while the taller tentacles are more numerous and closer to one another, until for a short distance behind the apex tall tentacles only are present.

No definite relationship exists between the relative positions of the longer and shorter tentacles of the two rows on the same leaf-margin; a long tentacle of one row being sometimes situated opposite a long tentacle of the opposite row, but quite as often there is no correspondence in position of the long tentacles, or there may be one or two small ones opposite a long one. There is also no correspondence between the position of the long and short tentacles on one margin in relation to those on the opposite margin of the leaf.

A fifth row of tentacles is found on the mid-rib of the under side of the leaf (Fig. 3). The tentacles here show variations and alternations in size similar to those of the marginal rows, but the tallest tentacles are only half (a few may be almost two-

thirds) of the length of the tallest marginal tentacles, and have thicker heads and stalks. The glands of these tentacles seem to have greater activity than the marginal ones, at least the amount of secretion present is larger, and in all herbarium specimens the greater proportion of insects caught are found adhering to them.

The tallest tentacles are always situated on the central part of the mid-rib, the smaller ones occur not only on the central part but on each side of it.

Between this central row of tentacles and the marginal rows there is an area of leaf-surface devoid of tentacles (Figs. 3, 5).

The upper side of the leaf bears a number of long narrow unicellular hairs directed upwards parallel with the leaf-surface (Fig. 4). These hairs have thick walls and are present in largest number at the base of the leaf. They decrease in number and in size upwards and are wanting in the upper two-thirds or half of the leaf. The under surface has no hairs (Fig. 5).

The venation is typically droseraceous. There is a well-developed mid-rib, and a marginal vein. This marginal vein receives branches from the mid-rib at intervals of about a centimeter and these give a general appearance of symmetry to the leaf (Fig. 6).

Stomata are present on both the upper and under surfaces. The guard-cells are raised slightly above the level of the surrounding tissue of the leaf, and there are no subsidiary cells (Figs. 7, 8).

Crystals of calcium oxalate are abundant, especially along the mid-rib. They also occur in smaller number along the marginal veins and on the branches passing from the mid-rib to the marginal veins (Figs. 9, 10), where they are often arranged close together in rows. They are present in the epidermis of the upper and under surfaces, in the chlorenchyma, and even in the large empty cells, to be afterwards described, situated below the mid-rib. These crystals are composed of a number of needles all pointing outwards from a centre.

The epidermis is a single layer of cells without chlorophyll. The cuticle is not very thick, the outer, radial, and inner walls of the epidermis are all thin. The mesophyll of the leaf is not divided up into palisade and spongy parenchyma, but consists simply of small round cells, sometimes polygonal, separated by

numerous intercellular spaces. Just underneath the vascular bundle of the mid-rib is a group of large cells which do not seem to have protoplasmic contents. The vascular bundle is surrounded by an endodermis of polygonal and rounded cells.

On the upper side of the vascular bundle and above the endodermis, and separated from the epidermis by a single layer of chlorenchyma, is a crescent-shaped group of sclerenchyma ; and between the endodermis and the large loose tissue underneath the vascular bundle is another similar group. The xylem is situated in the centre of the bundle, and at the two lower corners there is a single phloem-group. These two phloem-groups are quite separate from one another, and are not united to each other in the middle line under the xylem.

The above description of the anatomy of the leaf applies to a section about its base or middle. Towards the apex the structure changes. At the base it is dorsiventral and swollen near the mid-rib, with the sides of the lamina nearly horizontal (Fig. 11). Upward the laminar sides become smaller (Fig. 12), more raised from the horizontal (Fig. 13) and thicker, until the outline of the leaf on transverse section appears like a thick flattened U (Fig 14). Close to the apex the laminar sides disappear, so that the outline becomes circular. The vascular bundle is here situated in the centre, surrounded by a ring of chlorenchyma, outside of which is the epidermis in the outline of a circle (Fig. 15). The large loose cells situated underneath the vascular bundle at the base of the leaf are less developed towards the apex, where they entirely disappear. At the base they are separated from the epidermis by a single layer of small cells which do not bear chlorophyll. About the upper third of the leaf they become fewer in number and smaller in size, and form a small group separated from the upper epidermis by two layers of chlorenchyma. At the apex they gradually merge into the bundle-sheath. This circular apical part of the leaf gradually passes into the terminal tentacle, so that it is quite impossible to say where the leaf ends and the pedicel of the tentacle begins.

The structure of the marginal vascular bundles is similar to that of the large central one, only on a smaller scale.

LEAF OF RORIDULA DENTATA.

The leaf is much larger than that of *R. Gorgonias*. The longest which I was able to examine measured about 10 cm. while the width at the base was scarcely 1 cm. As in *R. Gorgonias*, the leaf is broadest for the lower third of its length, above which it gradually narrows to a point. It differs from that of *R. Gorgonias* in being pinnatifido-dentate, the side teeth being about 1 to 1·5 cm. in length (Fig. 16). These teeth make an angle of about 30° with the mid-rib, but where the teeth are not long the angle may be about 90°. The teeth on opposite margins of the leaf have no relation to each other; at the base of a leaf they are often opposite, at the apex alternate. Each tooth ends in a tentacle, as does the apex of the leaf itself.

The leaf is more thickly clothed with tentacles than is that of *R. Gorgonias*, and the tentacles are not arranged in definite rows but are scattered indefinitely over the leaf, the taller ones being most abundant on the side branches, while the smaller ones are most frequent on the margin and upper surface of the leaf (Fig. 17).

The side branches increase in size and distance from each other from the base to the apex, the largest branches being found just a little distance behind the apex. Each branch has a terminal tentacle, behind which are several irregularly-placed long tentacles. The smaller tentacles are as a rule absent from the upper half of the leaflet, but are usually well developed on the lower half, especially at the base. The longer tentacles project from the leaflet in all directions, but, although they show a tendency to be distributed in rows, there is no definite arrangement which will hold for all the branches of any one leaf.

It is along the margin of the leaf, however, that the greatest development of tentacles is found. These are mostly of the smaller sizes, but scattered irregularly amongst them is a number of the larger tentacles such as occur on the side branches, as well as others intermediate in size between them and the very numerous small ones. There is also a development of small thick-walled unicellular hairs (Figs. 32, 33), which are only about a quarter of the length of those found on the

upper leaf-surface of *R. Gorgonias*, and they are not only well developed on the upper surface, but equally so on the margins and under surface.

The upper surface of the leaf is thickly covered, especially at the basal part, with these unicellular hairs, which gradually decrease in number and size upwards, being almost entirely wanting from the upper half of the leaf. Scattered amongst these hairs is a number of very small tentacles either equalling or about double the size of the hairs themselves (Figs. 18, 19). These hairs and, in many cases, also the small tentacles stand out from the leaf at right angles.

There is no distinct row of tentacles developed on the under side of the mid-rib, but only a few scattered medium-sized tentacles, mostly situated at some distance from each other. The small tentacles are very poorly developed along the mid-rib, but occur to a slight extent on the surface of the leaf between the mid-rib and the margins along with the unicellular hairs.

The droseraceous venation is present showing a well-developed mid-rib (Fig. 20) and marginal vein from which a single branch is given off opposite each of the teeth. This branch passes up the centre of the tooth and ends at the base of the terminal tentacle. The central vein and the marginal veins unite together close to the apex. At the base of each tooth a single vein arises from the marginal vein, and runs inwards to meet the central vein at about the level of the next tooth.

There are stomata on both the upper and under epidermis. These are similar to those of *R. Gorgonias*, and show as in that species beak-like projections of the cuticle.

Calcium-oxalate crystals are abundant, especially along the mid-rib. They also occur along the other veins, and, to a less extent, in the tissue between. They are found both in the epidermis and in the mesophyll of the leaf.

On transverse section the leaf appears much swollen about the mid-rib, and from this the laminar sides extend out almost horizontally (Fig. 21). The cuticle is not specially thickly developed. The epidermis is a single row of cells without chlorophyll; their outer, inner, and radial walls are thin. The mesophyll shows, as in Droseraceæ, no differentiation into

palisade and spongy parenchyma, but only elongated chlorenchyma cells united together at their extremities and forming irregular rows between which are large intercellular spaces. Underneath the vascular bundle there are numerous large loose cells of irregular outline, and small intercellular spaces. Outside this is a crescentic group of pitted sclerenchyma-elements, and there is a similar group occurring above the bundle, and separated from the epidermis by a single row of cells. The central vascular bundle itself is surrounded by a sheath, one or two cells thick on the flanks and on the lower side but much thicker on the upper. A gradual passage may be traced between them and the sclerenchymatous cells. The xylem is well developed. The phloem is divided into two groups, which approach each other closely in the middle line though they do not meet.

The structure of the teeth resembles that of the apex leaf (Fig. 22). The vascular bundle runs up the centre as far as the pedicel of the terminal tentacle which it enters. In structure it resembles that of the mid-rib except that the large loose cells are absent. Stomata are fairly numerous, and the epidermis bears no chlorophyll. The chlorenchyma consists of elongated cells resembling those of the mesophyll of the leaf, and form a ring around the vascular bundle.

STRUCTURE OF TENTACLES OF RORIDULA.

Although the arrangement of the tentacles is different in the two species, their structure is similar, and one description will suffice, therefore, for both.

The glands of *Roridula* are pedicellate, and vary in size from small ones, which require the aid of a lens to be visible, to large ones about 1 cm. in length.

They all have essentially the same construction, which is typically seen in one of the larger glands, namely, a pluricellular *pedicel* bearing at its extremity an ovoid swelling, the *glandular head* (Fig. 23).

THE PEDICEL.—This is usually slightly swollen at its point of origin from the epidermis of the leaf, but above the base is of uniform thickness. It agrees with the corresponding structure in *Drosera* and *Drosophyllum* in being pluricellular, but differs

in the absence of a vascular strand traversing its centre. It has three layers (Fig. 24) of which the outermost consists of about twenty parallel cell-rows. The cells of these rows are elongated in the long direction of the pedicel, being about two to three times as long as they are broad. They have thin outer walls and thin radial walls, and are firmly united together laterally. The second or intermediate layer consists of from six to eight parallel cell-rows, and surrounds the third or innermost layer, which usually consists of one cell-row occupying the centre of the pedicel.

THE GLANDULAR HEAD.—This is seated on the end of the pedicel and appears as an ovoid swelling, circular on transverse section (Fig. 26). In structure it resembles the pedicel. In the centre is a single cell-row, not digestive, a continuation of the central row of the pedicel. The intermediate layer forms a dome-shaped cover over the central row (Fig. 25). The cells of the outermost layers are *gland-cells*, and are a continuation of the outermost layer of the pedicel. If any one row of cells is traced from the pedicel into the glandular head its cells, which are elongated in the stalk, will become shorter, then square, and finally flattened.

The gland-cells themselves are united to those of the intermediate row by their inner surfaces, but there is no connection between adjacent gland-cells, that is to say, the lateral walls of the gland-cells do not touch, and each gland-cell is therefore free along its sides (Figs. 25, 26).

As in *Drosera* and *Drosophyllum* there are no pores on the gland-cells for the extrusion of secretion.

The smaller tentacles differ from the larger ones only in simplification of the construction. A section through the head of one of the smaller tentacles (Fig. 27) shows only a single central cell-row to which the gland-cells are attached and the intermediate cell-layer is wanting (Fig. 28). In a still similar tentacle (Fig. 29) the head is composed of the layer of gland-cells alone, and even here the gland-cells are not united to each other laterally (Fig. 30). In the simplest form of all, the tentacle consists of one cell-row, the lower cells of which are elongated and form the pedicel, while the upper cells are flattened and form the glandular head.

All the tentacles of *R. Gorgonias* and *R. dentata* are formed on one common plan of construction; and it is possible to trace a series of gradually increasing complexity, beginning with the smallest tentacles and ending with the tallest.

EVOLUTION OF THE DROSERACEOUS TENTACLE.

In general microscopic structure as well as in the type of construction of the tentacles *Roridula* is droseraceous and the tentacles show more primitive features than do those of other genera of the family, with the possible exception of *Byblis*, the systematic position of which is at present doubtful.

In order to bring out the relationship, I may start from the simplest tentacles of *Roridula* and thence trace a series of gradually increasing complexity up to the tentacles of *Drosera* itself.

The simplest gland I have seen was on a young stem of *Roridula dentata*. It consisted of a pedicel of a single row of three or four elongated cells continued at the extremity into a row of five or six flattened cells. The whole appeared as if it might have been formed by the repeated division of a single epidermal cell. Such glands are not common and are also to be found on the leaf. They are difficult to detect owing to their small size.

More complex are those tentacles in which the pedicel consists of two rows of cells, and then of three rows of cells, ending in a head containing a similar number of secreting gland-cells which, although originally united, have become separated laterally, so that they are connected with each other at their outer and inner extremities only. The three rows of cells of the pedicel are of the same thickness throughout, but the basal part may be thicker than the upper, more of the epidermal cells having been brought into the formation.

A further advance is shown in tentacles composed of four or five rows of cells with base of the pedicel thicker than the upper part.

By continued increase in the number of cell-rows more complex tentacles are developed. One row of cells may become enclosed by the others which form a ring round it. In the head of such a tentacle we see on transverse section a circle of

secreting gland-cells separated from each other laterally, but united by their inner walls to a single central cell, which does not secrete, but gives a support to the secreting cells.

More complex still is the condition where a third layer of cells has been developed between the outer gland-cells and the central row. This is the stage which most of the taller tentacles of *Roridula* have reached.

All these tentacles are simply epidermal out-growths of the nature of hairs. In none of them is there a central carrying-group of tracheids. But at the base of some of the longer tentacles, which are found just behind the apex of the leaf, there is sometimes a slight development of tracheid-tissue which passes into the pedicel for barely a quarter of its length, and into the tentacle terminating the leaf (and each of its side-branches in the case of *Roridula dentata*), a tracheid-strand is continued from the mid-rib into the centre of the stalk in its lower half or two-thirds (Fig. 30). It never reaches the head.

These terminal tentacles are the most highly developed of all the tentacles found either on the leaf or stem, and may be compared directly with the tentacles found on the leaves of *Drosera.*

The tentacle of *Drosera* may be considered to be derived from a type resembling that of *Roridula.* The tentacles in the two genera agree closely in length of pedicel and in length and diameter of head, but the vascular strand which traverses the pedicel and ends in a number of tracheid-cells occupying the centre of the head of the tentacle of *Drosera* is only foreshadowed in the tentacle of *Roridula.* The tracheid-cells in the centre of the head of *Drosera* represent the innermost row of cells and its surrounding layer in *Roridula.*

The outer layer of gland-cells of the tentacle of *Drosera* arranged in two rows. an outer and an inner, are continuous with one cell-row of the pedicel, not with two, and correspond to the single row of gland-cells in *Roridula.*

The most striking structural difference between the tentacles is the presence in *Drosera* of the so-called *middle layer.*

Apart from structure, its power of movement at once marks out the tentacle of *Drosera* as an organ showing advance upon that of *Roridula.* Darwin, in "Insectivorous plants," points out that the seat of movement in the tentacle of

Drosera is the base of the pedicel, and concludes that the lower part of the tentacle represents a prolongation of the leaf. Confirmation of this view is supplied by the terminal tentacle of *Roridula*, of which the basal part of the pedicel is a portion of the tissue of the leaf, while the upper part is of the nature of a hair. The other tentacles of *Roridula* are obviously hairs, but in some of the taller ones there seems to be a tendency for the tissue of the leaf to become merged in the base of the pedicel. In the case of *Drosera*, all the taller tentacles have undergone this modification, their basal part representing a prolongation of the tissue of the leaf, their upper part being of the nature of hairs, so that movement is limited to the basal part.

I was unable to determine whether all the tentacles of *Roridula* are similar in function or not, but the evidence seems to show that the tall marginal tentacles are losing their digestive function, and becoming of the nature of catching tentacles, and we should have then a foreshadowing of the division of work amongst the tentacles that is characteristic of *Drosophyllum*, with its catching pedicellate tentacles and digestive sessile glands, which are alike, structurally, in the possession of two layers of gland-cells—a middle layer, and a tracheid strand. Sessile glands are absent from the leaves of *Roridula;* there we have smaller tentacles, only simpler in structure. I would suggest, on the basis of this comparison, that the sessile glands of *Drosophyllum* are derived from the pedicellate rather than that the converse development has taken place. The primitive form of the droseraceous tentacle was evidently a hair, and length of pedicel and complexity in the structure of the head have increased equally. When these tentacles were able to attract and capture insects, the insects would ultimately sink down on the surface of the leaf, bearing the tentacles with them, because if these remained standing out from the leaf they would not be able to digest or absorb any nutritive matter; this bending of the tentacles would be apt to break them. This is prevented, in the case of *Drosera*, by the power of movement at the base, which brings about incurving and subsequent re-erection of the tentacle. In *Drosophyllum* this power of movement has not been acquired, and in order that the head of the tentacle may be brought near the insect the pedicel has

become shortened until, ultimately, it has completely disappeared, while those tentacles which have not undergone this shortening have lost the power of digestion, which would be of no use to them, since the head of the tentacle would not be brought in contact with the body of the insect after it had fallen on to the leaf. The glistening drop of secretion formed on these tentacles is, however, advantageous to the plant for attracting insects and capturing them.

ACTIVITY OF THE GLANDS OF RORIDULA GORGONIAS.

The plant experimented upon was kept in a plant-house in the Royal Botanic Garden, Edinburgh, at a temperature between 50° and 60° C. The experiments were carried out during the months of November and the beginning of December. The plant was, unfortunately, thriving very badly at the time, and died about the middle of December, before the experiments had been concluded.

The plant stood close to several plants of *Byblis gigantea*, and although the glands seemed to all outward appearance to be secreting properly, the number of insects caught was exceedingly small; while the leaves of the active *Byblis* were crowded with insects.

This might be due to the fact that *Roridula* has not the same attraction for insects as *Byblis*, a view, however, which is scarcely consistent with the large number of the glands which in this case were all more or less actively secreting; or, as seems more probable, it might be due to the plant being in bad health at the time.

In order to determine whether the tentacles possess power of movement, I repeatedly irritated them by means of a sharply pointed needle, but was never able to observe any signs of movement, nor after placing small cubes of albumen on the glands did I observe any inflection of the tentacles.

The secretion from the larger tentacles is neutral to litmus paper, but in one or two cases the secretion from the smaller glands was slightly acid.

I placed a small cube of albumen upon one of the glands situated at the back of the mid-rib. After 24 hours the angles and edges of the tube had been rounded off, and, after a further

period of 24 hours it appeared as a small round mass. This, at the end of the third day, had diminished in size, and at the close of the fourth day, *i.e.*, after 96 hours, had entirely disappeared, or, rather, had been digested.

I then placed a drop of solution of $Am_2 CO_3$ upon one of the glands, and found that it became darkened, thus showing that the glands have the power of absorption.

Small cubes of albumen were also placed upon the glands at the margin of the leaf, but these were not disolved after a week, possibly pointing to the fact that these glands are not digestive. I was unable, unfortunately, to conduct sufficient experiments to make certain of this fact.

As might be predicted from their structure and relationships, the uni-cellular hairs of the upper surface of the leaf have no digestive power. Cubes of albumen placed upon them were unchanged after a week. Their function is that probably of the similar hairs of *R. dentata*, to prevent too much transpiration from the surface of the leaf, so that as much water as possible may be available for the tentacles.

The plants upon which the above experiments were carried out were about five inches high. At the end of the stem there were four green leaves which were able to assimilate; below these was a single withered brown leaf, the tentacles of which were, however, covered by drops of secretion, just as if the leaf on which they were situated had been perfectly healthy. I placed two small cubes of albumen upon two of these glands, and found that, after four days had elapsed these small cubes showed no signs of being digested. Shortly after this the upper four leaves also withered, and then, and not till then, did the drops of secretion upon the glands on this fifth leaf disappear. This would seem to point to the fact that the presence of these drops of secretion are simply due to hydrostatic pressure. This is the more remarkable when it is remembered that there is no vascular tissue in the stalk of the tentacles of the *Roridula*. The upper four leaves were able to draw up a sufficient supply of water, and some of this transpiration current passing along the vascular tissue of the withered leaf found its way to the glands, where it appeared in the form of glistening drops, the continual evaporation of which would draw up more water and thus keep the supply constant.

STRUCTURE OF STEM.

In the largest specimen of *R. dentata* that I was able to examine, the diameter of the stem was about 1 cm. It was bare of tentacles, which had been thrown off with bark. The consistence is hard. On transverse section of an old stem there is visible a poorly-developed pith of small cells, a mass of dense wood composing the bulk of the stem, and traversed by numerous long, narrow medullary rays. On the outside is a small bark.

Young stems show a large central pith, and just outside the phlœm is an endodermis of five or six cells in one layer, but here and there there may be two layers. Outside this is a sheath of sclerenchyma-cells, which may in places be four or five rows thick.

The cortex is composed of large irregular cells with numerous intercellular spaces. The epidermal cells have a thick cuticle and no chlorophyll. The radial walls of the cells are thin, the outer and inner walls thick. Beneath the epidermis is a single row of cells of about the same size as the epidermal cells, with which they alternate in position. Their radial walls are also thin, while the outer and inner walls are thick.

R. Gorgonias is like *R. dentata* in stem-structure.

STRUCTURE OF ROOT.

R. Gorgonias has a well-developed root showing a large central axis with numerous lateral rootlets. It is tetrarch. The large root system in *Roridula*, which in its adaptation to insectivorous habit seems to me to show the most primitive construction amongst the Droseraceæ, is of interest as pointing to the conclusion that the acquisition of the insectivorous habit was not due to a difficulty in absorption from the soil through defect in the root-system.

R. dentata conforms in root-features to *R. Gorgonias*.

EXPLANATION OF THE FIGURES IN PLATES XX. and XXI.

Illustrating Mr. A. Ninian Bruce's Paper on the Tentacles of *Roridula*.

The following references apply to all the figures :—A. Sp., Air-spaces ; B. S., Bundle-sheath ; C. C., Central row of cells ; Ch., Chlorenchyma ; Cr., Crystals ; E.C., Empty cells ; Ep., Epidermis ; Gl., Gland ; L., Leaflet ; M., Midrib ; M. V., Marginal vein ; P., Pedicel ; Ph., Phloem ; Scl., Sclerenchyma ; St., Stoma ; S. T., Spiral tracheids ; T., Tentacle ; T. t., Terminal tentacle ; U. h., Unicellular hair ; V. B., Vascular bundle ; X., Xylem.

PLATE XX.

FIGS. 1-15.—*Roridula Gorgonias*, Planch.

FIG. 1.—Leaf.

FIG. 2.—Apex of leaf.

FIG. 3.—Scheme of leaf in transverse section to show position of marginal tentacles.

FIG. 4.—Upper surface of base of leaf.

FIG. 5.—Under surface of base of leaf.

FIG. 6.—Portion from middle of leaf to show venation.

FIG. 7.—Stoma of leaf in surface view.

FIG. 8.—Stoma of leaf in vertical section.

FIG. 9.—Under side of leaf showing distribution of lime-oxalate crystals.

FIG. 10.—Upper side of leaf showing distribution of lime-oxalate crystals.

FIGS. 11-15.—Leaf in transverse section at intervals from base to apex.

FIGS. 16-22.—*Roridula dentata*, Linn.

FIG. 16.—Leaf.

PLATE XXI.

FIG. 17.—Leaf lobe.

FIG. 18.—Upper surface of leaf.

FIG. 19.—Under surface of leaf.

FIG. 20.—Portion from middle of leaf showing venation.

FIG. 21.—Leaf in transverse section.

FIG. 22.—Lateral leaf-lobe in transverse section.

FIGS. 23-31.—Tentacles of *Roridula*.

FIG. 23.—Large tentacle.

FIG. 24.—Pedicel of large tentacle in transverse section.

FIG. 25.—Head of large tentacle in longitudinal section.

FIG. 26.—Head of large tentacle in transverse section.

FIG. 27.—Medium-sized tentacle.

FIG. 28.—Head of medium-sized tentacle in transverse section.

FIG. 29.—Small tentacle.

FIG. 30.—Head of small tentacle in transverse section.

FIG. 31.—Apex of leaf showing vascular bundle passing into base of end tentacles.

FIGS. 32 and 33.—Unicellular hair on upper surface of leaf of *Roridula dentata*, Linn.

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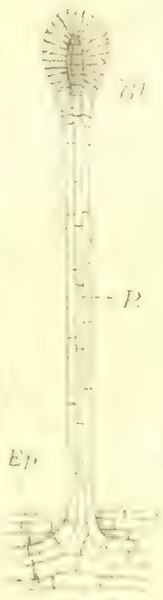

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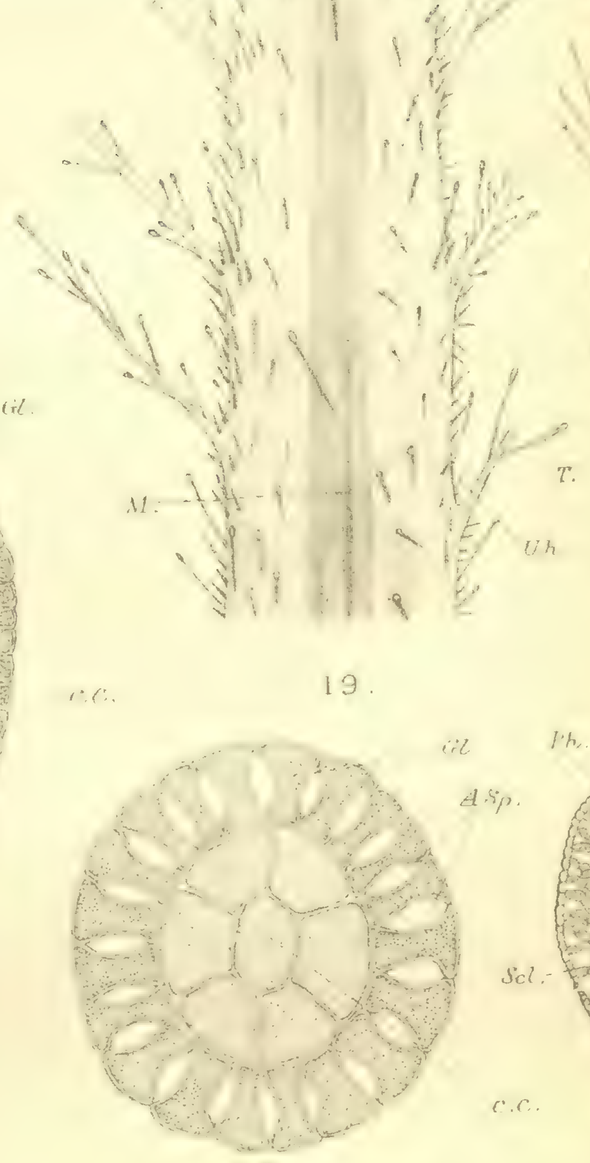

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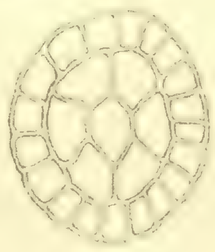
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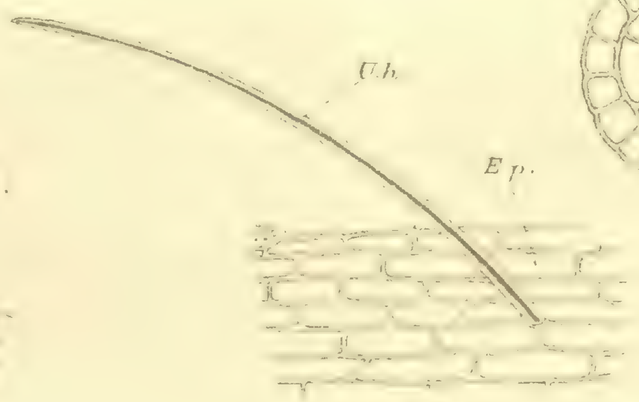

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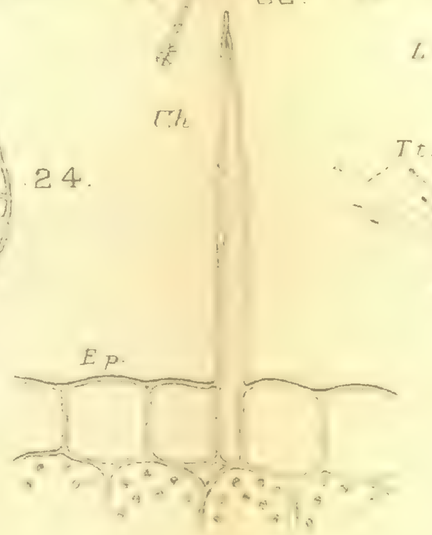

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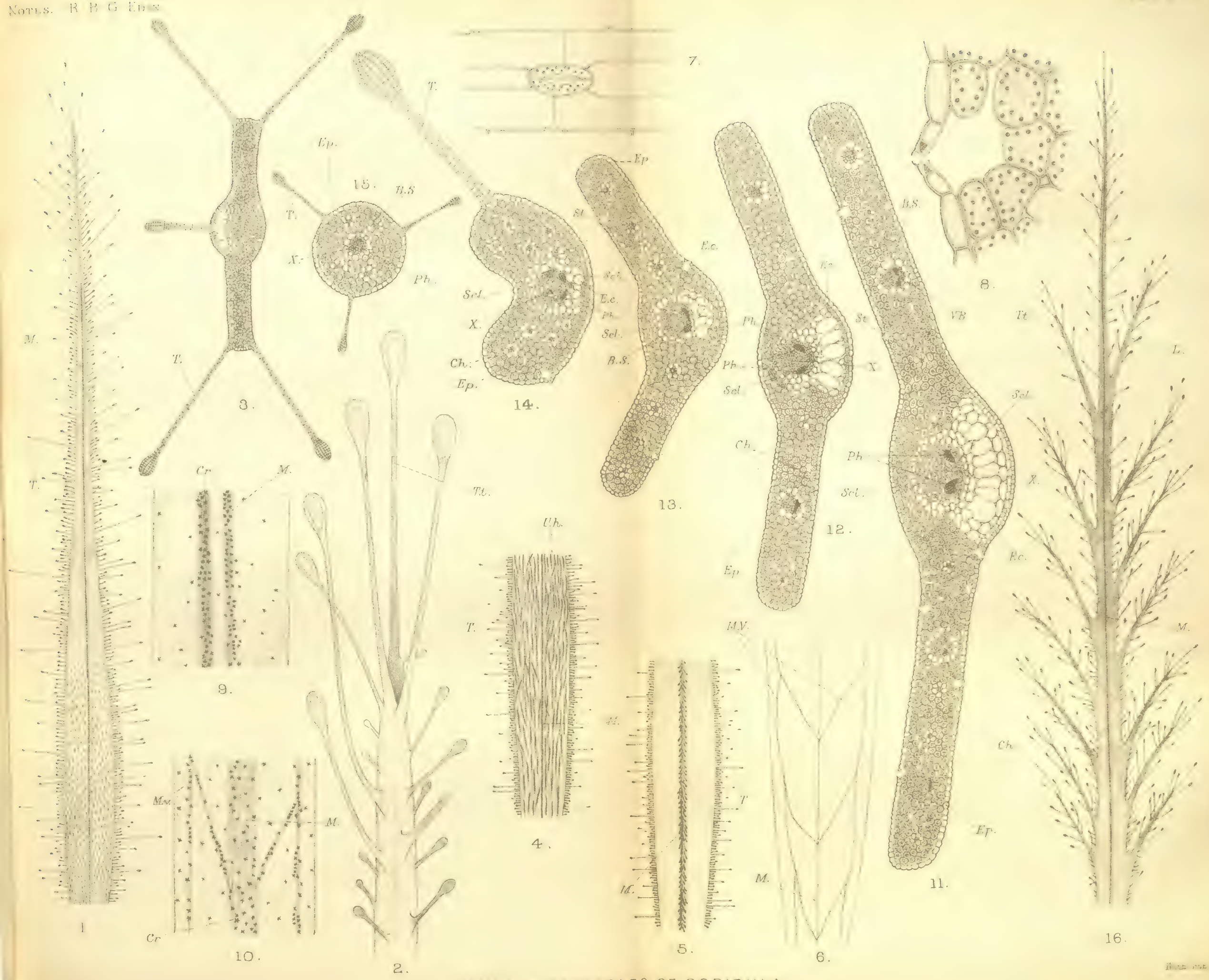

BRUCE — TENTACLES OF RORIDULA.

Notes on the Animal Life of the Hothouses of the Royal Botanic Garden, Edinburgh.

BY

ROBERT GODFREY.

During the summer of 1903 Mr. James Waterston recognised an exotic ant running on one of the botanical specimens in the Botany class-room, and was in consequence prompted to begin in the following year a series of enquiries—in which he generously asked me to co-operate—into the natural history of the hothouses. Through the kindness of Professor Bayley Balfour we were allowed unrestrained access to the hothouses, and in the foreman of the Glass Department, Mr. Stewart, and his subordinates we have found very willing allies.

The animal life of the hothouses, both in its wealth and in its variety, surpassed all our expectations; and, imported unintentionally as it has been from all quarters of the globe, it affords the most striking evidence possible of the part played by man in the distribution of species. Insects and shells from Central and Southern Europe are living here side by side with species from America and the West Indies. Under inverted flowerpots and in similar dark corners the Australian cockroach hides by day, and among the plants in the Orchid-house a large jumping-spider—identified by Rev. O. Pickard-Cambridge as *Hasarius adansonii*, Sav.—lives and thrives, spending part of his time in stalking bluebottles and other insects and springing upon his prey from as great a distance as eighteen inches (a spring of this extent having been carefully measured by Mr. Stewart). In the mould of the propagating-frames a millipede, strange to the eyes of Scottish naturalists, and a large planarian worm have long been thoroughly acclimatised, and a pretty little isopod is established in the same retreats. Among the other

curious tenants of the houses may be mentioned a tiny phasmid noticed on one of the plants in the autumn of 1904.

The real difficulties connected with the study of these exotic forms arise from the inability of determining with accuracy the place of origin of the different species, and from the trouble experienced in getting into touch with specialists in the various branches represented by the different creatures. Yet, in connection with the shells and the ants at least, we have achieved some success, and we venture to think that a few notes regarding these branches of natural history as exhibited in the hothouses may not be unwelcome to those who have hitherto regarded these buildings as strictly reserved for plants.

SHELLS.

Of shells, we make out at present seven exotic species, exclusive of the possibly imported but genuinely British *Cæcilioides acicula*, Müller, a dead specimen of which was found on the under side of a brick in the old Fern-house, on February 28, 1905.

Stenogyra goodallii, Miller.—A very common hothouse species, *Stenogyra goodallii*, Miller, a transparent white turreted shell, flourishes in the side pots in the hotter portion of the Palm-house, where we noticed it first on June 9, 1904.

Hyalinia cantabrica, Westerl.—In the old Fern-house, where *Cæcilioides* occurred, a large dark *Hyalinia* used to thrive among the gravel covering the various platforms, and probably still exists in the new locality to which the gravel has been removed. This has been identified by Mr. G. K. Gude as *Hyalinia cantabrica*, Westerl., a native of Spain. A second species of *Hyalinia*, small and delicate, from a different hothouse, cannot be determined at present.

Zonitoides minusculus, Binn.—Much smaller than this last-mentioned shell is a white helicoid species, which Mr. Gude thinks may be *Zonitoides minusculus*, Binn., a native of the United States of America and of Japan.

Besides these we have a dead pupa, found by Mr. Stewart in a propagating-frame on June 13, 1904, but not yet identified.

Two species of fresh-water shells—a *Limnæa* and a *Physa*—live in the water-tubs in the hotter part of the Palm-house. The *Limnæa* remains still undetermined, but the *Physa* is apparently *Ph. acuta.*

ANTS.

In the other branch to which we have devoted special attention —the ants—we have detected six species.

Tetramorium guineense, Fabr.—By far the most abundant is the species which led us to these investigations, and which has been identified for us by Mr. Edward Saunders as *Tetramorium guineense*, Fabr. It is almost universally distributed through the houses, running actively about the wooden platforms and over the plants. This species sometimes attends on the scale-insects, "milking its cows," according to the popular phraseology. It makes its nests in the corner of the frames, and forms occasionally as the approach to its nest an ingenious earth tunnel along the angle formed by two sides of the frame. Winged specimens are about by June 9, and may be met with till the end of September. On September 28, 1904, I observed a number of workers tugging viciously at the wings and head of winged females, as if they would tear the creatures in pieces. On being disturbed, both workers and females ran off, but ere long the females were again helpless in the workers' hands. I took this as the sign of the settling of a new nest.

Technomyrmex albipes, Smith, var. **brunneipes,** Forel.—The second species to which we were introduced is a black ant, of even more active habits than the last, but much more restricted in its distribution than that species. By preference it haunts plants infested by scale-insects, over which insects it builds chambers of earth to protect them and to keep them prisoners. Mr. Stewart, who introduced us to this ant in June 1904, opened several such chambers in our presence and

directed our attention to an ant "milking one of the cows." Colonel Bingham identifies this species as *Technomyrmex albipes*, Smith, var. *brunneipes*, Forel.

Strumigenys incisa, Forel.—On June 10, 1904, I detected in a propagating-frame a minute yellowish-red ant, furnished with a formidable mouth-apparatus. I sent it off at once to South Kensington, and, inferring from the nature of the reply received that special interest attached to the find, I instituted a careful search for additional specimens, which were also in their turns dispatched to South Kensington. The species was determined to be *Strumigenys incisa*, Forel., from the West Indies, and up to that time had been represented in the National Collection by a single female only, the type specimen. This species was again found in the summer of 1905 by Mr. Stewart.

Ponera punctatissima, Roger.—Mr. Stewart, on June 13, 1904, found a colony of a fourth species in a propagating-frame, where the heat was about 85° Fahr. This proved to be *Ponera punctatissima*, Roger, a South European species. It has not turned up elsewhere in the hothouses.

Tapinoma melanocephalum, Fabr.—The fifth species of ant was met with in the first instance under circumstances which graphically indicated the means of importation. On the morning of June 14, 1904, Mr. Stewart was re-potting an orchid that had newly arrived from Hamburg; in addition to the plant there was in the pot a nest of ants, *Tapinoma melanocephalum*, Fabr., belonging to a species which, as Colonel Bingham, who identified it, informs us, has spread pretty nearly over both hemispheres. That this ant is firmly established in the hothouses was proved by the finding of colonies later on. Mr. Stewart handed me further supplies of this species on August 3, 1904, and on February 28, 1905.

Plagiolepis exigua, Forel.—The sixth species is so abundant in parts of the hothouses that, but for its exceedingly minute size, it could not have remained so long undetected. I first noticed it on August 3, 1904, on the woodwork of the hotter portion of the Palm-house, where it ran so rapidly as almost to

defy my attempts to capture unharmed specimens. I had indeed to spend a second day collecting with the greatest care before I had specimens fit for proper examination. To Colonel Bingham again we are indebted for the name, *Plagiolepis exigua*, Forel. Later on Mr. Stewart discovered this species in the Aroid-house, and in December 1905 he showed me their nesting haunts, inside the hollow metal rods from which the pitcher-plants are suspended.

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NOTES

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EDINBURGH.

AUGUST 1907.

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Effect of Environment on the Hypocotyl in the Genus Luzula.

BY

W. EDGAR EVANS, B.Sc.,

CARNEGIE SCHOLAR IN BOTANY.

With Plate XXII.

I have thought it best to divide the contents of this short paper into two parts ; the bulk of the observations and descriptions forming the first of these, and the second containing a few remarks on the minute anatomy of the hypocotyl. My best thanks are due to Prof. Bayley Balfour, under whose supervision the work has been carried out at the Royal Botanic Garden, Edinburgh, for the facilities he has at all times allowed me, and for help in many other ways.

PART I.

On comparing some seedlings of *Luzula purpurea*, Link., germinated this spring with a series collected from a sowing made last year, I was struck by a marked difference in the appearance of the seedlings in the two gatherings. In both cases the seed had not been separated from the capsule, or from the flower perianth enclosing it ; and it was owing to this fact that my attention was at first arrested. The seedlings germinated last year corresponded to the description given by Laurent (1) : the green cotyledon bearing on its apex the seed, along with the first foliage leaves formed a rosette, while the primary root arose almost directly below this, owing to the extreme shortness—amounting almost to absence—of the hypocotyl. The remains of the perianth and

capsule, where present, were in this way situated immediately below the point of origin of the foliage leaves, the primary root having bored its way through these relics of the parent plant in its elongation (Fig. 2). On the other hand, the seedlings germinated this spring, while corresponding in other respects with the foregoing description, showed the remains of capsule and perianth as though carried downwards for some considerable distance by the primary root in its growth (Fig. 1). How was this difference to be accounted for?

Upon closer observation it was noticable, in the case of the seedlings in which the remains of the flower parts were situated some distance from the leaves, that what I had at first taken to be a portion of the primary root lying above the remains of these flower parts—which had previously surrounded the seed—was thicker and more transparent than the undoubted primary roots of the seedlings in the other series, and differed in the same respects from what I had thought to be its continuation beyond the perianth segments envesting it. The probability of its being an elongation of the short hypocotyl described by Laurent (1) then occurred to me; and a consideration of the type of germination which, according to him, is common to all the Juncaceæ (and which I had already observed myself in the case of *Juncus glaucus*, Sibth.), as well as other points to be mentioned later, convinced me that this was the truth. A short account of those features of this germination which bear upon the present case may help to make my point clearer.

Owing to the elongation of the cotyledonary axis on growth commencing, the embryonic primary root is thrust outwards through the micropyle of the seed. The cotyledon continues still to elongate, bringing the root pole into contact with surrounding material, and later, when the plantlet has become firmly attached to the rooting-medium, growing upwards as the first green leaf of the plant, and carrying on its apex the seed. Immediately the rudimentary root comes into touch with any surface, a collar of long root hairs appears at its upper limit, which serve to anchor the young plant and allow the primary root the leverage necessary for the burrowing operations it has soon to commence. This fixation of the starting-point of the root before its elongation is what I wish to emphasise, because,

if we imagine a seed to germinate thus within the remains of the perianth and capsule, it seems clear that they cannot be carried downward by the root, since they are firmly held by the fixing hairs, as had undoubtedly happened in the case of the seedlings collected last year.

No trace of a piliferous layer can be seen throughout the whole length of this structure—in some cases more than half an inch in length—which separates the leaves from the flower parts which had enveloped the seeds, in this year's seedlings. Moreover, lateral roots, when developed upon it later, arise in acropetal succession.

On seeking an explanation for the difference in growth of the two lots of seedlings, I at once remembered that, while last year I had sown all the seeds I was observing on the surface of moist fibre or other material, this year, owing to certain failures in germination, I had had all my seeds sown in the ordinary way, below the surface, in pots of sandy soil. Fortunately, the whole of the seedlings which interested me had not been removed from the pot in which they were growing, and on examination it was found that the seeds had been sown exactly as far below the soil surface as the hypocotyl had elongated. That this was so, was made very clear by the fact that, though some seeds had been considerably nearer the surface than others, the hypocotyl had only elongated sufficiently to bring the plumule above ground. In other words, the elongation was just sufficient to raise the embryonic shoot to the surface of the earth.

Being anxious to ascertain the subsequent fate of the hypocotyl, a number of seedlings were kept growing for a time and examined at intervals. It was found that very soon lateral roots began to appear, arising from the central vascular cylinder, clearly visible in the hypocotyl. The first of these usually appeared about the same time as the first foliage leaf began to emerge from the sheath of the cotyledon. It was situated, as a rule, in the lower half of the hypocotyl, very often quite close to the primary root. One by one other similar lateral roots arose above the first, each stronger and thicker than that preceeding it; till finally, when about the third foliage leaf had appeared, several lateral roots arose from the base of the leafy rosette (Figs. 4-7). Very soon quite a bunch of these roots had been formed, and the hypocotyl, with the roots it bore, began to shrivel. Within three

months from the date of germination, there only remained an almost indistinguishable brown thread, in the midst of the functional roots, to mark its former position. It is interesting to note that the cotyledon was at that time still quite green, and as yet showed no signs of decay ; it remained an active assimilating organ for a considerable period after the total disappearance of the hypocotyl.

My next step was to ascertain the environmental conditions under which the species grew, in case this might throw some light on the use of such an expansion of the embryonal axis to the plant.

Luzula purpurea, Link., is a native of the Canary Islands and Madeira, and according to Buchenau (2) its habitat is in shady, moist places in rock clefts in wooded valleys ; he also states that it is the only known annual species of the genus. The surroundings of the plant would therefore appear to be very similar to those in which such of our British luzulas as *L. maxima*, DC., and *L. vernalis*, DC., are usually met with. For this reason it seemed likely that, in these species also, a similar development might be found to occur. I was, however, only able to obtain a small supply of seeds of *L. maxima*, DC., and of *L. campestris*, DC. Some of the seed was in each case sown upon the surface, some under about a quarter of an inch, of soil. In both cases the same results were observed as in the case of *L. purpurea*, Link., already described, with the exception that the germination below ground was much poorer in the case of the two British species. The experience of Mr. L. Stewart, at present Foreman of the Glass Department in the Royal Botanic Garden here, agrees with mine in this respect, for he informs me that *L. purpurea*, Link., is more easily raised from seed sown below the soil than is any other species of *Luzula* he has knowledge of.

I had now satisfied myself that the case of *L. purpurea*, Link., was no exception to the general rule, and that the behaviour of its hypocotyl was not caused by the fact that it was an annual, but must have to do with the environment which the genus, as a whole, tends to favour. The seeds of a plant growing in a shady, wooded situation, where the soil is very loose and the leaf-fall great, must tend to become more

or less buried before germination—which is often long delayed amongst luzulas—commences. A means of bringing the leaves of the seedling above the material covering the seed would give the young plant a much more favourable start in its life.

Apparently, under ordinary conditions, the internodes of the stem itself take no part in the work performed by the hypocotyl, but remain quite as short as in a surface-grown seedling. The possibility of their elongating if necessary is, however, hinted at by the fact that one of my seedlings of *L. maxima*, DC., germinated below ground, showed the first internode of the shoot elongated as well as the hypocotyl (Fig. 3). Why this seedling should have developed in this exceptional way I am unable to explain, as the seed was no more deeply covered by the soil than any of the others, and the internode between the base of the cotyledon and the first foliage leaf projected entirely above the earth. According to Sorauer (3), two internodes (apparently the so-called mesocotyl and the first internode of the stem) take part in bringing to the vicinity of the surface the leaves of too deeply sown rye seedlings. In surface-sown plants these two internodes remain contracted and closely superposed.

An experiment was made to test the effect upon the hypocotyl of lack of sufficient light at the time of germination. A surface sowing was made of seed of *L. campestris*, DC., and the pots of soil placed in almost complete darkness. The seed germinated readily, and, as I had expected, the hypocotyl became elongated in the same way as before, though to a rather less extent. A longitudinal section through the median plane of one of these seedlings is shown in Fig. 8, the drawing being, unfortunately, in part diagramatic, owing to the large cortical cells having become much crushed in the process of embedding in paraffin. It is probable, then, that lack of light is the chief stimulus in causing the elongation of the hypocotyl in seedlings of *Luzula*, which would hardly ever be so deeply buried in the soil as the rye seedlings mentioned by Sorauer (3), who attributed the elongation in their case to a need for better aeration.

I have not been able to observe any phenomena such as those described above in the genus *Juncus*.

PART II.

The description of the minute anatomy of seedlings of *Luzula* given by Laurent (1), in his excellent and exhaustive treatise on the development of the Juncaceæ, is that of surface germinated plants. He shows the hypocotyl as extremely short, and speaks of the almost immediate change from root arrangement (alternating) to cotyledonary arrangement (superposed) of the xylem and phloem in the vascular system. I was anxious to ascertain the structure found in the elongated hypocotyl, in case the transition should prove more gradual; and I also determined to examine seedlings at a later stage than those observed by Laurent, so that they might have had time to develop sufficiently to give some idea of the passage from hypocotylar to shoot arrangement. Unfortunately the results of this quest—which proved much more difficult than I expected—were very unsatisfactory. Sections were cut both by hand and in the microtome, the specimens being embedded in paraffin in the latter case, using xylol as the solvent for the wax. The comparatively large size of the thin walled, almost empty cortical cells made it impossible to prevent them from being crushed during the process of infiltration; while hand cut sections were not sufficiently fine for the purpose, and the tissues had not enough strength to resist the razor well when unembedded. Other difficulties were the numerous lateral roots which disturbed the vascular arrangement at short intervals; and the very imperfect differentiation of xylem and phloem due partly to the youth of the seedlings, partly to the transitory nature of the hypocotyl. First, then, I shall describe a transverse section through the hypocotyl, cut about midway between its extremities; and shall afterwards explain, as far as I have been able to make them out, the changes which take place on passing downwards or upwards from this point.

In such a central section we find a vascular core, completely surrounded by a very well marked endodermis, and representing about one-third of the diameter of the hypocotyl. The tissues to the exterior of the endodermis, forming the cortex, are composed of large, thin-walled cells, almost devoid of contents, thus giving a very transparent appearance to the axis when examined as a whole. The cells of the outermost layer of this cortex do not

show the thickening of their exterior walls so often seen in epidermal cells, and are in fact quite similar to those situated further within the tissues; no root-hairs or other outgrowths are anywhere produced by them. Within the endodermis an arrangement, quite like that of a root, is observable, and in all but one of the sections examined a diarch symmetry was seen (Fig. 10). The exception was a seedling of *L. campestris*, DC., where a faintly developed third xylem and phloem were noticed (Fig. 9).

In passing downwards from the section described no difference is visible, and the vascular system passes into the primary root, apparently without any alteration except a distinct narrowing of its area just as it reaches the region where the collar of fixing hairs arises.

Passing upwards, we find that the xylem and phloem become more and more difficult to determine, but continue to occupy the same relative positions so long as they can be distinguished (Fig. 15). The endodermis remains very obvious, and no other change is seen till quite close to the upper limit of the hypocotyl. Then, quite suddenly, there become evolved from the mass within the endodermis three separate bundles, one larger than the other two (Fig. 14). Next, the marked endodermis disappears from the side of the stele next the largest of these bundles, while the other two become somewhat oval in outline (Fig. 13). This point marks the upper limit of the hypocotyl, for immediately above it we find the largest bundle passing to the side into the cotyledon, now seen (Fig. 12) partly attached to and partly sheathing the shoot, into which the two oval bundles have passed, each dividing into two in doing so, and giving rise to four bundles lying near its centre. A little higher still, where the cotyledon has become quite separated from the shoot, we find these four bundles more separated from one another (Fig. 11).

It would thus appear that the structure of the stele in the elongated hypocotyl of *Luzula* is typically that of a diarch root throughout almost the whole of its course. Many similar hypocotyls have been described, especially amongst Dicotyledones by Hill (4), Tansley and Thomas (5), and others; while Miss Sargant (6) has pointed out that amongst Monocotyledones the transitional region between stem and root is always of extreme shortness, in her experience rarely reaching a length of

3 mm. even in arborescent forms, and being often much shorter than the external limits of the hypocotyl. My hope of finding a more gradual passage from root to shoot arrangement was thus not realised.

SUMMARY.

1. Under natural conditions the hypocotyl in the genus *Luzula* is actively concerned in raising the plumule of young seedlings to the surface of the soil, if the seeds have become buried. The fact that this elongation has not been noted in previous papers on the subject is probably due to the method usually employed in such observations—germination upon the surface of moist material such as cotton, blotting paper, &c. Under such conditions the hypocotyl remains unelongated.

2. Seedlings grown at the surface, but in darkness, show a similarly elongated hypocotyl, the stimulus to elongation being probably lack of sufficient light.

3. The amount of elongation always corresponds exactly to the depth of the sowing of the seed.

4. Normally the epicotyl takes no part in the elongation, remaining quite unelongated when the hypocotyl may be as much as ½ in. long.

5. The primary root and the hypocotyl are very short-lived, being early replaced by secondary roots arising just below the leaves.

6. The stele of the elongated hypocotyl shows typical symmetry of a diarch root.

7. I have not observed similar phenomena in the genus *Juncus*.

LITERATURE CITED.

1. LAURENT, M. Recherches sur le Développement des Joncées. Ann. des Sci. Nat. Série 8., t. xix. 1904.
2. BUCHENAU, F. Juncaceæ in Engler's Pflanzenreich.
3. SORAUER, P. Handbuch der Pflanzenkrankheiten. Vol. i., pp. 110–112. 1905.
4. HILL, T. G. The Seedling Structure of certain Piperaceæ. New Phytologist. Vol. iii., No. 2. 1904.
5. TANSLEY, A. G., and Thomas, E. N. Root Structure in the Central Cylinder of the Hypocotyl. New Phytologist. Vol. iii., No. 4. 1904.
6. SARGANT, Miss E. A Theory of the Origin of Monocotyledones, founded on the Structure of their Seedlings. Annals of Botany, Vol. xvii., No. 65. 1903.

EXPLANATION OF FIGURES IN PLATE XXII.

Illustrating Mr. W. Edgar Evans' paper on "The Effect of Environment on the Hypocotyl in the genus *Luzula*."

FIG. 1. Seedling of *Luzula purpurea*, Link., from sowing made below the soil surface, showing elongation of the hypocotyl. . . . . × 16.

FIG. 2. Seedling of *L. purpurea* from surface sowing. . . . . × 16.

FIG. 3. Seedling of *L. maxima*, DC., from sowing covered by soil, showing the elongation of both hypocotyl and first internode of the shoot. . × 16.

FIGS. 4–7. Stages in the growth of *L. purpurea* seedlings. . . . . n. s.

FIG. 8. Longitudinal section through hypocotyl and plumule in a seedling of *L. campestris*, DC. (slightly diagramatic). . . × about 400.

FIG. 9. Transverse section through the hypocotylar stele of *L. campestris*, about its middle point, showing triarch arrangement (unusual). Highly magnified.

FIG. 10. Transverse section through the hypocotylar stele of *L. purpurea*, about its middle point, showing diarch arrangement (normal). Highly magnified.

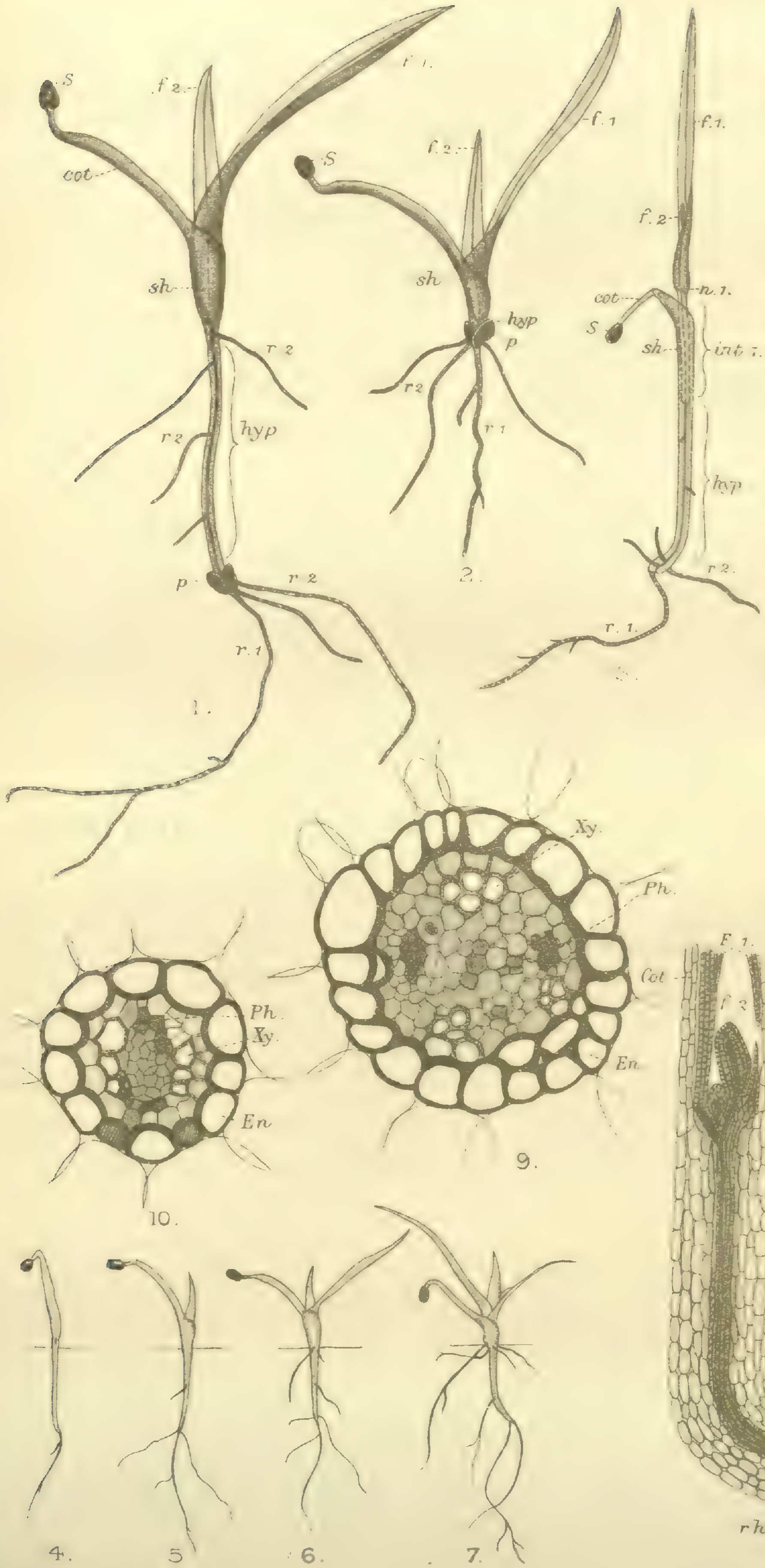
FIG. 11. Diagram of arrangement of vascular bundles at a point above the junction of shoot and cotyledon. (Trans. Sect. *L. purpurea*).

FIG. 12. Diagram of arrangement of vascular bundles at the point of junction of shoot and cotyledon. (T. S. *L. purpurea*).

FIGS. 13–15. Diagrams showing stages in the passage from the arrangement of the bundles shown in Fig. 12 to that found throughout the greater length of the hypocotyl. (T. S. hypocotyl, *L. purpurea*).

EXPLANATION OF THE ABBREVIATIONS USED IN LETTERING THE FIGURES.

cot. = cotyledon.
en. = endodermis.
f. (1, 2, &c.) = foliage leaf (1st, 2nd, &c.)
hyp. = hypocotyl.
int. (1.) = internode of shoot (1st).
n. (1.) = node of shoot (1st).
p. = remains of perianth and capsule.
ph. = phloem.
r. (1, 2,) = root, (primary, secondary).
r.h. = region of fixing root hairs.
s. = seed.
sh. = sheath of cotyledon.
sht. = shoot axis.
xy. = xylem.



W. Edgar Evans del.

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EVANS —— HYPOCOTYL OF LUZULA.

Warty Disease of Potato.

BY

A. W. BORTHWICK, Sc.D.

With Plate XXIII.

The recognition of this disease is of comparatively recent date. It was first described by Schilbersky[1]. The infected tubers were sent to him from Upper Hungary. A few years later, Professor Potter[2] discovered the same disease in England, an outbreak having occurred in Cheshire. Dr. R. Stewart Macdougall[3] has also recorded the occurrence of the disease in the same county. The Board of Agriculture has also issued a leaflet dealing with it. Further, several articles have appeared in the "Gardeners' Chronicle." In one of these, Dr. M. C. Cook[4] mentions the disease as occurring in Cheshire, North Wales, and other localities, and according to information which I have recently received from Professor Potter, the disease is not unknown in the South of Scotland. The disease, therefore, is spreading, and it has undoubtedly reached the Midlands of Scotland, the illustrations accompanying this article being all taken from material sent from Stirlingshire. The disease is clearly rapidly spreading, and although it is not yet known to be doing an alarming amount of damage, still its continued increase is sufficiently ominous, and potato growers would do well to take warning in time and to exercise strict supervision of their crops.

Attention was drawn to the outbreak in Scotland, to which I am about to refer, by Mr. Robert Forbes, Overseer of Kennet Estate, Alloa, who sent the diseased material to the Royal Botanic Garden along with the following description of its occurrence :—

[Notes, R.B.G., Edin., No. XVIII., August 1907.]

"The diseased potatoes were grown in 1906, on a piece of large "garden ground at Kennet Village, the property of Lord Balfour "of Burleigh, in the County of Clackmannan, the area of the "ground being about 24 poles in extent. The kinds of potatoes "grown were British Queen, Up-to-Dates, Scottish Triumph, "Herd Laddie, and Princess May Kidney. The whole crop was "damaged to the extent that they could not be used. They were "quite useless, the early varieties being, if anything, worse than "the late—especially the early Kidneys. The disease was first "noticed when the new potatoes began to form. It first appeared "on the stems as a greenish-looking canker, which attacked the "tubers as they grew and soon made them into a mass of "corruption. The ground on which the diseased potatoes grew "is the ordinary black garden soil about 15 inches deep, resting on "clayey till. The surface soil seems to be a good deal mixed "with furnace ashes, and does not appear to be very pure black "soil. The same ground was planted with potatoes in 1905, and "there was no disease then, or at least, if there was, it had been "so slight that it had not been taken notice of. It is said that "the disease was noticed in a few of the neighbouring gardens "in 1906, but if it did exist it was only very slightly. The "dwelling-house in connection with this piece of ground was "partly rebuilt in 1905–06, and some of the lime rubbish from "the building was spread on part of this ground. The part on "which the rubbish was put was the worst part with the "disease."

Examination of the tuber showed that sometimes only a few localised warty excrescences, or again the whole potato, was converted into a coral-like mass. Figs. 12 to 18 show the general appearance of the malady. The excrescences are the result of the irritation caused by a parasitic fungus which inhabits the parenchyma-cells near the surface.

On examining the tissues microscopically, numerous resting spores were to be seen in the infested parts. They occurred most abundantly in the outer layers—see Fig. 8, which is a photo-micrograph of a median longitudinal section, also Fig. 11, which is a small portion photographed under a higher magnification while Figs. 7 and 10 are low and high-power photomicrographs of surface sections. In this condition of spores the fungus passes

the winter, and experiment[5] has proved that they are able to propagate the disease from year to year.

The extent of damage done varies. Fig. 3 shows the diseased tubers in various stages of attack. On the upper offset to the left, the oldest or first-formed tubers have been totally destroyed. It is interesting to note, as may be seen in this figure and also in Fig. 6, that the deeper-lying tubers have escaped, which would suggest that the fungus confines itself to the upper layers of soil.

Tubers which have been badly attacked rot away in the ground or dry and shrivel up when kept. Figs. 1 and 2 are photographs of specimens which had lain in a box for a few weeks.

On the tubers themselves the first symptoms of attack appear at the "eyes," where warty excrescences of various sizes may be seen (see Fig. 18). As regards the nature of these excrescences, Professor Potter says :—"Judging from some sections in an early "stage, the attack appears to commence at the 'eyes,' the parasite "easily gaining an entrance into the outer cells of the young and "tender structures which normally would develop into leaves. In "these the cells are readily stimulated to divide, and, as a result of "the injury caused by the parasitic invasion, irregular cell-division "is set up. The destruction of any one cell causes those in "contact with it to divide in the attempt to heal the wound; "when these latter cells are attacked in their turn, a further cell-"division is induced, and by a repetition of the process the leaf-"protuberances become converted into an irregular cell-mass "which in the initial stages may be seen as finger-like out-"growths. From these points the irritation spreads along the "cork-cambium, so that the cells over a large portion of the "surface of the potato gradually undergo this irregular division "and multiplication, which is extended also into the internal "tissues."

I entirely agree with the statements of the author just quoted, and in support of the view of the foliar origin of these protuberances I may point out that they are to be found in the foliage leaves themselves—a fact which, so far as I know, has not been recorded previously. In Fig. 4 one or two groups of excrescences may be seen on the separate lobes which on close examination appeared as branches from the leaf. The nature of these branches is shown in Fig. 5; and Fig. 9, which is also a photo-

micrograph of one of these swellings, shows the presence of the resting sporangia of the fungus to the left. Again, in Fig. 3, where the haulm forks at the surface of the soil, malformed and warty leaves are quite evident. The same thing may also be seen at the apax of the stolon to the left of the same figure.

The parasite, it would seem, is able to obtain a lodgement in others parts of the plant than the tubers, and as the resting sporangia found in all these tissues are capable of propagating the disease, this would suggest the destruction of the whole plant by burning as a preventive to the further spread and infection. Diseased tubers should upon no account be used as "seed," because the sporangia contained in the infected tubers are as much the "seed" of the parasite as the tuber is the "seed" of the host, and such material will as surely reproduce the fungus as the potato plant.

The appearance of this disease in Scotland is as unfortunate as it is unwelcome, and no doubt new centres of infection will be reported from time to time as the disease spreads and becomes better known. Preventive measures, to be effective, must be adopted by all growers of potatoes; individual or isolated action although productive of some good, may be of no avail in a case of this kind, nor in the case of any other threatened epidemic. Infectious diseases among animals must be reported in order that prompt action may be taken in isolating and stamping out the malady before it has had time to spread, and no one will question the foresight and wisdom which lead to such regulations; but in regard to plants it is to be regretted that there is as yet no properly organised system of dealing with an outbreak or a threatened outbreak of diseases, although the loss occasioned in their case may be as serious as that caused in animals. The health of the potato crop in Scotland is of extreme importance not only to the country itself, but to other countries to which "seed" potatoes are sent; hence no effort should be spared in order to stamp out this new and recently introduced enemy to such an important food crop.

LITERATURE.

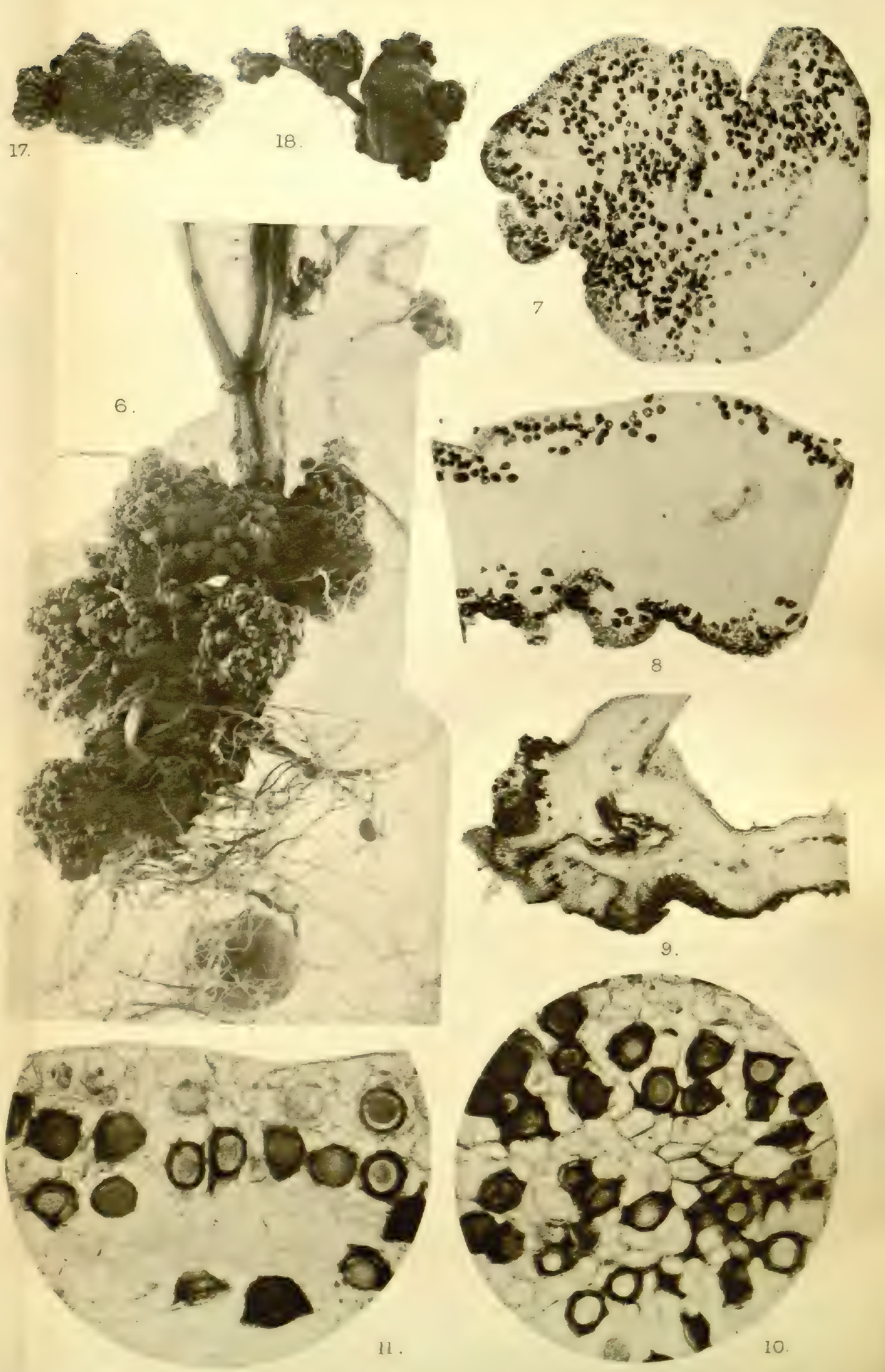
1. K. SCHILBERSKY. Ein neuer Schrofparasit der Kartoffel-knollen, in Berichte der Deutsch. Bot. Gesellsch., XIV (1896).
2. M. C. POTTER. A new potato disease (*Chrysophlyctis endobiotica*, Schilb.), in Journal of the Board of Agriculture, IX, p. 320.
3. R. S. MACDOUGALL. New fungus disease of potatoes (*Chrysophlyctis endobiotica*, Schilb.), in Trans. Highland and Agric. Soc. of Scotland, 1903.
4. M. C. COOK in Gardeners' Chronicle, 3rd Series, XXXIII (1903), p. 187.

DESCRIPTION OF FIGURES IN PLATE XXIII.

Illustrating Dr. Borthwick's paper on "Warty Disease of Potato."

FIGS. 1–2. Diseased tubers shrivelled and dried up.
FIG. 3. Haulm and offset with diseased leaves and tubers.
FIG. 4. Portion of foliage leaf with excrescences caused by the parasite.
FIG. 5. Leaf in transverse section at an excrescence.
FIG. 6. Diseased tubers preserved in weak alcohol as contrast to Figs. 1 and 2.
FIG. 7. Diseased tuber in surface section showing numerous sporangia.
FIG. 8. Papilla with sporangia aggregated in the surface layers in median longitudinal section.
FIG. 9. Attacked foliage leaf in section, with fungus-sporangia to the left.
FIG. 10. Portion of Fig. 7 more highly magnified.
FIG. 11. Portion of Fig. 8 more highly magnified.
FIGS. 12–18. Tubers in various stages of attack.

12.
13.
14.
15.
16.
1.
5.
2.
4.
3


17.
18.
7
6.
8
9.
11.
10.

Prop-Roots of the Laburnum.

BY

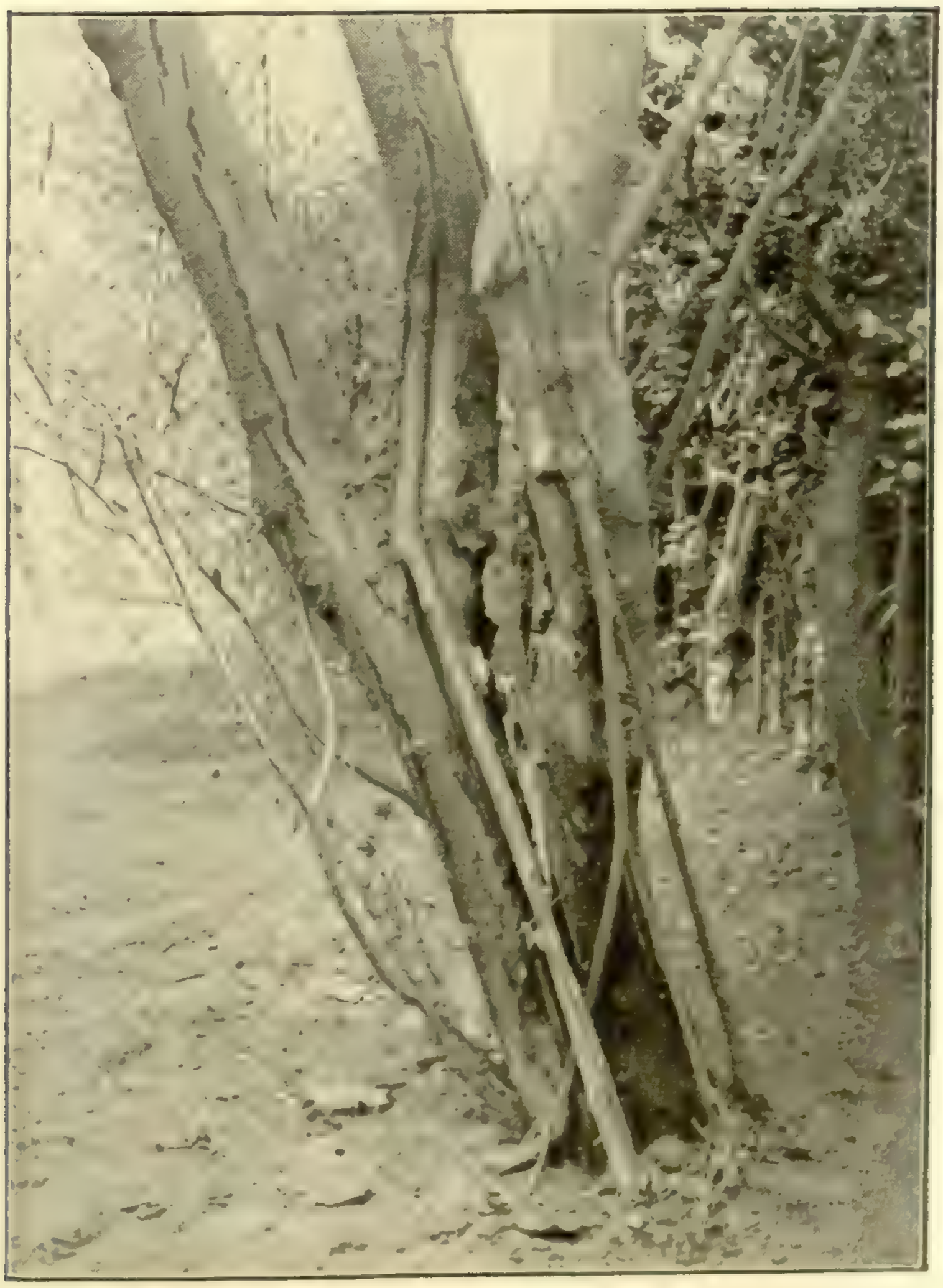
A. W. BORTHWICK, Sc.D.

With Plate XXIV.

In certain trees, such as the mangrove and screw-pine, as well as in lower-growing plants like species of *Stylidium*, the production of prop-roots has become a fixed characteristic feature. In the case of the tree forms mentioned, the prop-roots give the tree a much broader base and more points of attachment to the soft, slimy mud in which it grows, and they also form supporting buttresses which are better able than a single thick trunk to withstand the strain and stress of wind and waves. We have here an example of special adaptation to environment. When the tap-root and stem-base begin to decay they are replaced by the prop-roots. It is striking to find much the same kind of thing taking place in certain forest trees, where a damaged root-system is often made up for by the formation of adventitious roots around the stem-base. In some cases strong adventitious roots are produced at a considerable height from the ground; this may occasionally be seen in *Robinia Pseudacacia*. A few years ago a tree of this species near Edinburgh was blown down; the lower part of the trunk and root-system had been very much decayed, and after the fall there remained standing a strong adventitious root which had been produced in the neighbourhood of a cut-off branch some 12 or 14 feet from the ground. This root had grown down hidden from view between the bark and wood, which was totally decayed on one side of the trunk. On the sounder parts of the stem, at varying distances from the ground, several similar

smaller adventitious roots had been formed; these, no doubt, served to support the tree and kept it supplied with water and food material from the soil.

A striking example of such prop-roots on a laburnum tree was found by the Regius Keeper in the Royal Botanic Garden here, by whose permission I obtained the accompanying photographs from which the illustration in Plate XXIV. is taken. The tree stands close into a hedge at the east side of the Rock Garden. The surrounding trees and shrubs make it impossible to obtain a full-sized photograph. The tree is very much forked, and at some time the stem has split from the lower fork down to the ground. There is no record of when this occurred, but, judging from the appearance of the wood, the split is an old one. The illustration gives a view of the base. It shows the split and decayed condition of the under part of the trunk. Two strong prop-roots have been formed, each arising in the angle of a fork some five or six feet from the ground. These roots branch and firmly anchor themselves in the soil around the base of the tree. An examination showed that the left half of the tree was kept erect principally by means of its prop-root. Unfortunately, during the storms of the winter of 1904-05, this portion of the tree was blown down.



Eighteenth Century Records

OF

British Plants.

JOHN HOPE, W.S., of Moray Place, Edinburgh, who died in 1895, bequeathed to the Royal Botanic Garden a number of botanical books, papers, and drawings which had belonged to his grandfather, John Hope, who was Regius Keeper of the Garden from 1760-1786.

Amongst the manuscripts are two small note-books the contents of which are worthy of preservation in the pages of these "Notes."

One of these contains a number of records, of date 1764 and 1765, of stations for plants about Edinburgh and in other parts of Scotland. The fly-leaf at the beginning of the book bears, in Dr. Hope's writing, "List of plants growing in the neighbourhood of Edinburgh, collected, in flower, 1765, as a sketch of the Calendarium Florae of Edinburgh." The writing of the manuscript is not that of Dr. Hope, and internal evidence seems to show that he was not the compiler of the list, but it is manifest that he had looked through it, interpolated stations, and pointed out doubtful records.

Upon the first page there is the heading, "A list of plants as they were collected and prepared during the year 1764, with ye place of growth." Dr. Hope has interpolated the words "in flower" after "plants" in the heading—an expression we must accept in its widest signification as used by botanists in the eighteenth century, and as referring to the sporiferous condition of Thallophytes as well as to the flowers of Spermophytes. The list continues in calendar form from March 1764 until January 1765, when a couple of pages are blank; and the calendar

recommences with the date 14th May, and goes on until 30th October 1765, under the new heading, "A calendar of plants as they were found and prepared in the year 1765." The first portion of the list is emphatically one of plants in the vicinity of Edinburgh. There are in it but a few records of stations far afield. The second portion of the list has a much larger proportion of citations of localities distant from Edinburgh.*

The second note-book has on the fly-leaf, in Dr. Hope's writing, "A Catalogue of British Plants in Dr. Hope's Hortus Siccus, 1768," and the catalogue is in the same writing, with occasional interpolations, and there are entries of date subsequent to 1768.

These lists of eighteenth-century records have many features of interest, botanical and topographical, and they show us also that at the period referred to considerable attention was given to the flora of Scotland, and that field Botany was a definite part of the teaching of Botany by John Hope.

The lists are transcribed verbatim and without changes in the spelling—which is not altogether uniform—or the nomenclature.

The citation of the names of collectors and of those from whom Dr. Hope received the specimens has this additional interest, that, assuming, as we may, that they were field botanists, we are introduced to the names of several of whom there would appear to be no published record. It may be worth while to publish here the following list of the names of such collectors or donors as occur in the catalogues. When the name is to be found in Britten and Boulger's "Biographical Index of British and Irish Botanists" that work is cited. Some of the names have been identified as of Graduates in Medicine of the University of Edinburgh, and in these cases such information is given as is supplied by the "List of Edinburgh Medical Graduates"; where there may be a doubt in such identification, this is indicated. To the identity of several in the list there is no clue at present.

*A transcription of this list appeared in the "Annals of Scottish Natural History" for July and October, 1900, and January, 1901.

List of Names of Collectors or Donors mentioned in Dr. Hope's Catalogues.

Aiton, William. See Britt. and Boulg. Bibliog. Index.

Alchorne, Stanesby. Do. do.

Badenoch, Mr. Do. do.

Bard, Samuel. Born in America. M.D., Edin., 1765. Thesis: De viribus Opii.

Bryant, Rev. Henry. See Britt. and Boulg. Bibliog. Index.

Burges or **Burgess,** Rev. Dr. Do. do.

Charlesworth, Benjamin. Born in England. M.D., Edin., 1769. Thesis: De Peripneumonia vera.

Charteris, Mr.

Crosbie or **Crosby,** Mr.

De la Roche, Mr.

Fabricius, Frederick William Peter. Born in Denmark. M.D., Edin., 1767. Thesis: De Emetatrophia.

Freer, Adam. Born in Britain. M.D., Edin., 1767. Thesis: De Syphilitide venerea. (Is he the A. F. of the Catalogue?)

Gordon, Mr. (? if Alexander Gordon. Born in Scotland. M.D., Edin., 1754. Thesis: De Variolis).

Hudson, Wm. See Britt. and Boulg. Bibliog. Index.

Huggan, John. Born in Britain. M.D., Edin., 1771. Thesis: De Sanguine humano.

Irwin, Dr.

Kyle, Mr.

Langlands, Robert. Born in Scotland. M.D., Edin., 1750. Thesis: De Hydrope Anasarca.

Lee, Arthur. Born in Virginia. M.D., Edin., 1764. Thesis: De Cortice Peruviano. See Britt. and Boulg. Bibliog. Index.

Lightfoot, Rev. John. See Britt. and Boulg. Bibliog. Index.

Lind, James. See Britt. and Boulg. Bibliog. Index.

Menzies of Cult.

Menzies, Archibald. See Britt. and Boulg. Bibliog. Index.

Naesmyth or **Nasmyth,** Sir James. Baronet of Dawyck, Peeblesshire. m. Jean d. of Thomas Keith. Studied under Linnæus. M.P. for Peeblesshire, 1730-41. d. 4 Feb. 1779. *Nasmythia*, Huds. = *Eriocaulon*. See Dict. Nat. Biog.

Nasmyth, John.

Oakes or **Oaks,** Mr.

Pulteney, Richard. M.D, Edin., 1764. Thesis: De Cinchona Officinali. See Britt. and Boulg. Bibliog. Index.

Ramsay, Robert. Born in Scotland. M.D., Edin., 1757. Thesis: De Bile.

Robertson, James. See Britt. and Boulg. Bibliog. Index. (J. R. of the Catalogue.)

Simpson, Dr. Robert.

Skene, David. See Britt. and Boulg. Bibliog. Index.

Smith, Sir James Edward. Do. do.

Spense or **Spence,** David. Born in Britain. M.D., Edin., 1767. Thesis: De Sanguinis ex utero gravidarum et puerperarum profluviis.

Stewart, Rev. John. See Britt. and Boulg. Bibliog. Index.

Stevenson, Mr. R.

Storer, Mr. John.

Stuart, Rev. John. See Britt. and Boulg. Bibliog. Index.

Urquhart, Mr. (? if Robert Urquhart. Born in Britain. M.D., Edin., 1772. Thesis: De Ipecacuanha.)

Watson, Dr. Presumably the Dr. Watson of Hudson's Flora Anglica, Ed. II., Preface, p. iii.

Walker, Dr. John. See Britt. and Boulg. Bibliog. Index.

Williamson, John. See Notes, R.B.G., Edin., Vol. III., p. 18. (J. W. of the Catalogue.)

Yaldon, Mr. See Britt. and Boulg. Bibliog. Index.

List
of Plants Growing in the Neighbourhood of Edinburgh
Collected, in Flower, 1765, as a Sketch of the Calendarium Floræ of Edinburgh.

A LIST OF PLANTS IN FLOWER AS THEY WERE COLLECTED AND PREPARED DURING THE YEAR 1764, WITH YE PLACE OF GROWTH.

March 1.	Tussilago farfara.	By the water of Leeth down from the new well.
20.	,, petasites.	By the water of Leeth up from the new well.
Aprile 6.	Fragaria sterilis.	Opposite to the new well on the further side of ye mill burn.
	Ficaria verna.	In the west Church yard and St. Anns yards.
7.	Alsine medea.	On the west side of the Castle hill by the road side.
	Ulex europaeus.	A little below the new well.
	Lamium rubrum.	Below the new well by a hedge near a village.
12.	Cochlearia officinalis.	Upon the top of a wall at the back of the Cannongate.
	Arenaria saxatilis.	At Duddingstown Craigs.
	Cerastium semi-decandrium.	At Do. by the road side.
14.	Leontodon taraxacum.	By the sides of the hedges in the meadow and other places.
16.	Veronica hederifolia.	Below the new well by a hedge near a village.
	Caltha palustris.	In the meadow and west end of the north Loch.
	Thlaspi bursa-pastoris.	In many places by road sides and tops of walls.
20.	Cheiranthus cheiri.	On the Castle-hill Rocks.
26.	Chrysosplenium oppositifolium.	Up from the new well below the Brea.
	Geum rivale.	Up from the new well.
	Alchemilla vulgaris.	Near the new well by the roadside.
28.	Cardamine amara.	Below the new well plentifully.
	,, hirsuta.	On Salsbury Craigs.
	Draba verna.	On Do.
	Primula vulgaris.	In the Kings park.
	Mercurialis perennis.	In Do.

Aprile 30.	Primula veris.	At the foot of the rock of Salisbury Craigs.
	Ribes grosularia.	On Salisbury Craigs, Kings Park, and the Castle hill.
	Prunus spinosa.	Kings Park and Duddingstown Craigs.
May 1.	Lychnis dioica.	Above the new well.
	Lamium album.	Below the new well by the roadside.
2.	Cardamine petrea ?[1]	Salisbury Craigs.
	Cerastium vulgatum.	On the tops of walls and many other places.
	Myosotis scorpioides.	Duddingstown Craigs.
	Valeriana locusta.	At Do. and among corns.
4.	Statice armerea.	At the back of Musselburgh and in other places by the seaside.
	Stellaria holostea.	Salisbury Craigs.
6.	Viola canina.	Salisbury Craigs and Kings park.
	Oxalis acetocella.	At Do.
7.	Salix repens, fem.	
	" " mas.	
	Asperula odorata.	Salisbury Craigs.
8.	Salix arenaria, fem.	
	" " mas.	
	Juncus campestris.	In the Kings Park.
	" pilosis.	In Achindenny wood.
	" sylvaticus.	In Do.
	Cherophyllum temulum.	At the hermitage : frequent.[2]
9.	Cardamine pratensis.	In the Hunting-bog.
	Ranunculus hederaceus.	In a marsh without St. Anns yards at the Tirless.
10.	Anemone nemorosa.	Achendenny wood.
	Ranunculus auricomus.	In Do.
	Ajuga repens.	In Do.
11.	Silene amoena (at last agreed upon).	At the Petty cur by the roadside to Kinghorn.
12.	Ribes rubrum.	In the Lochrin of Micklour, Perthshire.
14.	Orchis mascula.	Achendenny wood.
	Vaccinium myrtillis.	At Do.
	Lysimachia nemorum.	At Do.
15.	Geranium molle.	Castle-hill.
	Orobus tuberosus.	Arthurs seat.
	Tormentilla reptans.	Salisbury craigs.
	Ranunculus Aquatilis.	Leeth Links.

[1] The mark of interrogation is an addition in different writing which is like that of Dr. Hope.

[2] This locality in Dr. Hope's writing.

May	16. Viola tricolor.	Among corns and by waysides.
	Lichen caninus.	In the Kings Park.
	,, stellaris.	
	,, candellarius.	
	Polygala vulgaris.	Salisbury craigs.
	Anthemis Cotula.	By way sides.
	Genista Anglica.	At Essendie in the fir Park.
	17. Glecoma hederacea.	On the south side of St. Anns yard wall betwixt it and ye marsh.
	Orchis morio.	Collintown wood.
	Fragaria vesca.	On the Dean Burn Brea above the lowest millns.
	Adoxa moschatellina.	On Breds hill. Hermitage.[1]
	Geranium moschatum.	At Leeth-walk by the wall side near ye new Garden.
	18. Pedicularis sylvatica.	
	Sysymbrium Nasturtium.	In the marsh near Dudingstown Loch.
	Prunus avium.	In woods.
	Veronica chamedrys.	By the way sides in many places.
	,, serpylifolia.	By Do.
	Spartium scoparum.	Collintown wood.
	Acer Pseudo Platanus.	Do.
	Fraxinus excelsior.	Do.
	Corylus avellana.	Do. — past the flower.
	Senecio vulgaris.	In many places.
	Ranunculus. auricomus.	In Collingtown wood.
	Crataegus oxyacantha.	On the water side below Roslin a little above Mavis bank.
	Rumex acetosa.	
	,, acetosella.	At Craig leeth Quarry.
	Menyanthes trifolia.	In the Hunting-bog. Loch-end.[1]
	19. Narcissus pseudonarcissus.	In low grounds below the Kirktown of Lethendie.
	Myrica gale.	In a marsh west from the Kirktown.
	Ranunculus acris.	In the Gray Friars Church yard.
	Plantago medea.	At eas Houses near Dalkeeth.
	Hyacinthus non-scriptus.	Kings park. The Hermitage, abundant.[1]
	Salix fusca, mas.	
	,, ,, fem.	
	,, purpurea, mas.	
	Eriophorum polystachion.	In the hunting Bog.
	,, vaginatum.	In a marsh coming from Achindenny.
	22. Scirpus palustris.	In Dudingstoun Loch.

[1] This in Dr. Hope's writing.

May 22.	Scleranthus annuis.	On walls and other barren grounds.
	Lotus corniculatus.	Kings Park.
	Ranunculus repens.	In the Gray Friars Church yard.
	Montia fontana.	At the sides of many marshes.
	Bunium Bulbocastanum	On Bredfoord hill, particularly among Corns.
	Plantago lanceolata.	Salisbury craigs and other pastures.
23.	Equisetum fluviatile.	Dudingstown Loch.
	" arvense.	In pastures.
	" limosum.	In Roslin wood.
	Lolium perenne.	In Pastures.
	Chenopodium Bonus henricus.	
24.	Sedum acre.	Salisbury Craigs.
	Ranunculus bulbosus.	Kings Park.
	Erysimum officinale.	
	Sinapis alba.	Among corns.
	Conium maculatum.	Castle hill.
25.	Equisetum sylvaticum.	In a thicket up from Roslin.
	Pinguicula vulgaris.	Pentland Hills.
28.	Veronica becabunga.	
	Fumaria officinalis.	Among corns.
	Rumex digynus? an scutatus.	At the Castle of Glamiss.
	Scrophularia vernalis.	At Kirkland, near St. Martin Perthshire, with an old wall.
29.	Lapsana communis.	By the road side to the new well at Provt. Drummonds Park.
	Hieracium pilosella.	Salisbury Craigs.
	Arenaria rubra.	
	Trifolium repens.	In the Gallows Park.
	Ornithopus perpusillus.	On the highway side a little beyond the Bridge of Earn.
30.	Veronica serpyllifolia.	
	Hordeum murinum.	At Provt. Drummonds Park dyke by the road side.
31.	Ranunculus sceleratus.	In the North Loch plentifully.
	Alium ursinum.	Kings Park and below Roslin.
	Sanicula Europaea.	Kings Park and in woods.
June 1.	Linum catharticum.	Salisbury Craigs.
	Anthyllis vulneraria.	Do.
	Hieracium dubium.	On St. Andrews Breas.
	Turritis hirsuta.	Salisbury Craigs.
	Reseda luteola.	On the top of old walls opposite to St. Anns yards.
	Vicia sativa.	At the new well.
	Geum urbanum.	On the other side of the burn betwixt the Dean Bridge and lowest milns.

June	1.	Sherardia arvensis.	Salisbury craigs.
		Nardus stricta.	Kings Park.
		Lolium perenne.	In every meadow.
	2.	Lithospermum arvense.	At Stock bridge as you cross the mill burn.
		Galium aparine.	Among corns by waysides.
		Malva sylvestris.	South side of the Castle hill.
		Valeriana locusta.	Salisbury crags.
		Geranium robertianum.	Do.
		Cucubalus behen.	By the road side as you pass Provost Drummonds Park.
		Thlaspi arvense.	A little below Stock bridge by the mill burn side.
		Pastinaca sativa.	On the breas west from Crail in Fife.
		Viola lutea, Hud.	On Bredfoord hill east side thereof.
		Lychnis viscaria.	On Duddingstown Craigs.
		Astragalus arenarius.	At Do.
		Rosa arvensis.	At Do.
		Geranium sanguineum.	On Salisbury Craigs.
		Cistus helianthemum.	On Do.
		Asplenium adiantum nigrum.	On the rocks of Duddingstown Craigs.
		„ ruta muraria.	On Do.
	3.	Aira cespitosa.	In woods.
		Dactylis glomeratus.	In meadows and by way sides.
		Aira cristata.	Salisbury craigs.
		Avena flavescens.	Do.
		Thymus serpyllum.	Do.
		Ervum soloniense.	Do.
		Trifolium pratense.	By way sides and in corn fields.
		Hieracium auricola.	Salisbury Craigs.
		Sonchus oleraceus.	By way sides.
		„ „ var. γ	By the road side along Duddingstown Craigs.
		Rumex crispus.	By way sides, etc.
		Oenanthe crocata.	In a dich near the road from Jocks lodge to Restalrig.
		Potomageton crispum.	Duddingstown Loch.
		Calitriche verna.	In a ditch at the north side of the Castle.
	4.	Geranium lucidum.	Upon the Castle hill north side of the Castle.
		Festuca fluitans.	In the north loch.
		Scandix anthriscus.	By Leeth walk.
		Brassica orientalis.	On the Castle hill north side.
		Scandix odorata.	On the other side of the water opposite to Capt. Ranies house.

June	4.	Polygonum aviculare.	Castle hill south side near the bottom at the road side.
	5.	Vicia sylvatica.	On Salisbury Craigs.
		Hyoscyamus niger.	On the Cart road side that leads up Salisbury Craigs.
		Salvia verbenaca.	On Do.
		Avena fatua.	On Salisbury Craigs.
		„ flavescens.	On Do.
		Briza media.	On Do.
		Aira cariophyllea.	On Do.
	6.	Lemna trisulca.	In loch-end Loch.
		Geranium disectum.	A little below Stock bridge by the mill burn side.
		Chrysanthemum leucanthemum.	In the Gallows Park in the sandy brea.
		Bunias cakile.	By the sea side east from Leeth.
		Arenaria peploides.	By Do.
		Scandex pecten.	Among corns frequently.
		Hieraclium sphondelium.	By the way sides in many places.
		Carex vesicaria.	In marshy places.
		„ saxatilis.	In the Kings park dry ground.
		Rhinanthus crista galli.	At Duddingstown Craigs below the foot road.
		Medicago lupulina.	
		Sedum villosum.	In a marsh at or rather near Cliver-hall south of Edinburgh.
		Veronica montana.	In groves and moist places of Achendenny wood and elsewhere.
		Geranium sylvaticum.	In Achendenny wood and almost every other wood.
		Plantago lanceolata.	In pastures almost every where.
		Juniperus communis.	Below Achendenny wood by the water side.
		Stellaria graminea var.	At the new well.
		Trollius europaeus.	In Achendenny wood scarce, but not so in the meadows at Whitburn.
		Eriophorum vaginatum.	In a marsh off the high road from Achendenny.
		Scirpus cespitosus.	In a marsh near the Dams not far from the Roslin road.
		Juncus conglomeratus.	On the Links going to Musselburgh.
		Betula alba.	In woods.
		Spergula arvensis.	Among bad corns on moist ground, and by the way sides.
		Veronica scutellata.	In a ditch at mire side.
		Ranunculus flammula.	In many marshes.

June	6.	Melampyrum sylvaticum.	In almost all woods.
	8.	Veronica officinalis.	At Dudingstown Craigs above the foot road.
		Galium montanum.	In the Kings park.
		Aegopodium podagraria.	By way sides.[1]
		Aphanes arvensis.	Kings Park.[2]
		Digitalis purpurea.	On the south side of Bredfoord-hill near the Hermitage.
		Sinapis nigra.	Among corns.
		„ arvensis.	Do.
		Raphanus raphanistrum.	Do.
	9.	Pedicularis palustris.	In a ditch below Dudingstown Craigs.
		Lychnis flos cuculi.	In a marsh hard by the Dukes walk.
		Antirrhinum linaria.	
		Urtica dioica.	
		Plantago maritima.	By the sea side east from Leeth.
		„ coronopus.	By Do.
	10.	Papaver argemone.	
		Daucus carota.	By road sides. J. H.[3]
		Papaver rhoeas.	Among corns.
		„ dubium.	Do.
	11.	Cerastium viscosum.	By the sea side east from Leeth.
		Poa annua.	
		„ trivialis.	
		„ aquatica.	A little above Leeth by the water side.
		Phalaris arundinacea.	
	12.	Scabiosa arvensis.	At the water of Leeth by the road side.
		Valeriana officinalis.	On Salisbury Craigs.
		Tragopogon pratense.	By the water of Leeth up from the new well by ye road side.
		Silene noctiflora.	At Provost Drummonds Park wall by the road side.
		Avena elatior.	Among corns.
		„ sativa.	
		Bromus sterilis.	
		„ secalinus.	
		„ „ hordeaceus.	
		Phleum nodosum.	
		„ pratense.	
	13.	Fucus nodosus.	Upon the stones and rocks on the sea shore.
		„ serratus.	On Do.
		„ exissus.	On Do.

[1] In Dr. Hope's writing. [2] *Idem.* [3] *Idem.*

June 13.	Fucus vesiculosus.	At the foot of Cramond water.
	„ filum.	In Pretycur harbour.
	„ siliquosus.	In cavern of the rocks of the sea at Dunglass.
	„ pinnatifidus.	On Leeth sands.
	„ spinosus.	On Do.
	„ saccaratus.	On Do.
	Rosa villosa.	At Stannis mills, Duddingstown Craigs and Lochend.
	Hipurus vulgaris.	In a marsh at Mire side.
	Triglochin palustre.	In Do.
	Rubus caesius.	By Muselburgh water above the bridge some way.
	Iris pseudocoris.	In the marsh at mire side.
	Aquilegia vulgaris.	In Collingtown wood south side of the water.
	Arenaria trinervia.	In Collingtown wood, marshy places.
	Anchusa sempervirens.	In Dunglass Den most plentifully.
	Carum carvi.	By Leeth walk.
	Cerastium tomentosum.	In Collingtown wood on a rock.
	Erica cinerea.	In Collingtown wood.
	Salix pentandria.	In Do.
	Carex hirta.	In a marsh south of Craig-lockhart.
	Urtica urens.	By a wall side on the Calton-hill.
	Alopecurus pratensis.	
	„ geniculatus.	
	Aira coerulea.	
	„ aquatica.	
14.	Epilobium montanum.	At the well.
	Symphytum officinale.	By a rivulet without the Kings park, yt runs from a marsh at the Dukes road.
	Spiræa ulmaria.	By the water of Leeth near the new well.
	Scrophularia nodosa.	On Salisbury Craigs.
	Saxifraga punctata.	In Collingtown wood north side of the water.
	Iris germanica.	At Red Hall Bridge upper and nearer side.
	Athamanta meum.	At Do.
	Erica tetralix.	
	Melica nutans.	
15.	Rosa canina.	
	Lonicera caprifolium.	In Collingtown wood, north side of the water.
	Rumex.	
	Turritis hirsuta.	On Salisbury Craigs.
	Orchis latifolia.	In the hunting bog.

June 15.	Rubus Idaeus.	On Salisbury Craigs.
	Poa rigida.	
	„ pratensis.	
16.	Alismaranunculoides.	In a ditch at a marsh near mire side.
	Orchis mascula.	In meadows.
	„ morio.	
	Ceratophyllum demersum.	In a ditch by a marsh at mire side.
	Juncus pilosus.	In Achendenny wood.
	„ sylvaticus.	In Do.
	Medicago falcata.	
	Vicia cracca.	
	Viburnum opulus.	A very little below Achendenny bridge.
	Melampyrum sylvaticum.	In Achendenny wood.
	Empetrum nigrum.	In Do. but more frequently in heathy grounds.
	Hieracium murorum.	On Salisbury craigs.
	Prunus padus.	In Achendenny wood.
	Ligustrum vulgare.	A little above Roslin in a thicket by the water side.
	Polytrichum vulgare.	On Pentland hills & Arthurs seat.
	Stachys sylvatica.	
	Polygonum bistorta.	By the water side a little up from Le-Swede in a meadow.
	Achillea millefolium.	
17.	Arenaria serpyllifolia.	
	Plantago major.	
	Iris siberica.	Immediately above Red Hall Bridge.
	„ Germanica.	At Do.
	Erica vulgaris.	
	Veronica arvensis.	
18.	Pyrola rotundifolia.	In Achdenny wood.
	Anthemis nobilis.	In a field at the Mill-town near Achendenny and above the Bleach field near Mavis B.
	Festuca ovina.	
	„ duriuscula.	
19.	Potomageton serratum.	
	Festuca elatior.	
	„ loliacea.	
	„ sylvatica.	
20.	Alisma plantago.	In the ditches of the meadow.
	Trifolium arvense.	On Duddingstown Craigs.
	Hypericum perforatum.	By the Water of Leeth near the new well.
	„ quadrangulum.	At Do.
21.	Jungermannia Tamarisefolia.	In the Kings Park & Castle Hill on moist rocks.

June	21.	Lichen caninus.	In the Kings Park.
		„ centrifugus.	In Do. on the stones.
		„ flavescens.	In Do. on Do.
		„ palescens.	Do.
		„ pixidatus.	Do.
	22.	Conferva gelatinosa.	
		„ bullosa.	
	23.	Ulva umbilicalis.	On stones within the sea mark.
		„ intestinalis.	On Do. at Do.
		„ compressa.	Do.
	24.	Lichen parietinus.	On old walls and trunkis of trees.
		„ farinaceus.	
		„ fraxineus.	On ash Trees.
		„ miniatus.	On the rocks of the Castle Hill as also of the Kings Park.
	26.	Chara vulgaris.	In a ditch at a marsh near mire side.
		„ hispida.	In and at Do.
	27.	Fontinalis squamosa.	With the two former.
		Polytrichum subrotundum.	On stones in the Kings Park.
July	1.	Polygonum persicaria.	
		Achillea ptarmica.	
		Trifolium medea.	
		Epilobium hirsutum.	
		Carduus acanthoides.	
	3.	Centaurea cyanus.	Among corns.
		Chrysanthemum segetum.	With Do.
		Cardamine amara.	At the water of Leeth near the new well.
		Nymphaea alba.	In Loch end Loch.
		„ lutea.	In Do.
		Potomageton lucens.	In Do.
		Artemesia vulgaris.	Among corns.
		Typha latifolia.	In Loch end Loch.
	4.	Dianthus glaucus.	On the eminence at Lockend and on Bredfoord Hill.
		Bromus giganteus.	
		„ ramosus.	
		Stachys palustris.	
		„ germanica [error[1]].	At the water of Leeth near the new well.
		Lithospermum officinale.	Found on the west side of the Castle hill & at Arlie Castle.
		Caucalis arvensis.	
		Cynoglossum officinale.	At Dunbar as also at Roslin.

[1] The word "error" is inserted here in Dr. Hope's writing.

July	5.	Lonicera periclimenum.	On Salisbury Craigs and a little below the Hermitage.
		Argrimonia eupatoria.	
		Sison inundatum.	In a Ditch on Leith links.[1]
		Sedum reflexum.	
		Sempervivum tectorum.	
		Chenopodium maritimum.	
	6.	Clinopodium vulgare.	On Salisbury Craigs.
		Hypericum pulchrum.	
		Juncus inflexus.	At the east end of Bredfoord hill by a marsh, and west of a village.
		Cochlearia coronopus.	By the sea side.
		Asplenium ceterach.	
		Allium viniale.	On Salisbury Duddingstown and Lochend rocks.
		Carduus maria.	On the west side of Castle-hill.
		Serratula arvensis.	Among Corns and by way sides plentifully.
		Carduus lanceolatus.	By the walk of Leeth, on the Castle hill, etc.
	7.	Epilobium ramosum.	
		Verbascum thapsus.	
		Carduus palustris.	
		Myriophyllum verticillatum.	In Duddingstown Loch.
		Lactuca virosa.	On Duddingstown Craigs and at Lochend.
		Crepis tectorum.	On Do.
		Potomageton perfoliatum.	In Lochend and Duddingstown lochs.
		Ononis spinosa.	On Salisbury and Duddingstown Craigs.
	8.	Solanum dulcamara.	In a hedge about a mile on this side of Dalkieth.[1]
		Circaea lutetiana.	In Achendenny wood.
		„ alpina.	In Do.
		Pteris aquilina.	On Bredfoord hill and Salisbury Craigs.
		Eupatorium canabinum.	In Dunglass den and by Roslin water.
		Scirpus setaceus.	In a marsh near mire side.
		Juncus bufonius.	In Do.
		Nardus stricta.	In the Kings park.

[1] In Dr. Hope's writing.

July	8	Sisymbrium sophia.	At Stock bridge, betwixt it and the water of Leeth.
	10.	Stachys arvensis.	
		Lemna minor.	At the north side of the Castle in a ditch.
		Lysimachia vulgaris.	By Dr. R. Ramsay. Also at the Wheem Dr. Hope.[1]
		Galium palustre.	At Duddingstown loch.
		Myriophyllum spicatum.	
		Chara hispida.	In a ditch by a marsh at mire side.
	11.	Thalictrum minus.	A little west from Lord Rosberrys Park among furs.
		Glaux maritima.	On the sea side at Dunglass, and about Cramond Isle.[2]
		Vinca minor.	In Collingtown wood. At the Hermitage on a Rock close to ye house.[3]
		Triglochin maritimum.	
		„ palustre.	In a marsh at mire side.
		Parietaria officinalis.	On Colt Bridge and St. Andrews walls. At Roslin.[3]
		Salsola kali.	By the sea side east from Leeth.
		Chelidonium majus.	
		Juncus nodosus.	At Cramond water.
		Cicuta virosa.	On the side of Lochend Loch.
		Ophrys paludosa.	
		Spergula pentandria.	Among Corns and way sides especially in sandy grounds.
		Prunella vulgaris.	
	12.	Rosa eglanteria.	
		Malva alcea.	On the road side as you enter Abernethie.
		Sagina procumbens.	
		Juncus bulbosus.	
		Boletus bovinus.	In woods.
		Ononis arvensis.	Salisbury Craigs.
		Scabiosa succisa.	In pastures plentifully.
		Iberis amara.	Near Stockbridge at the steps on which you cross the water.
		Papaver somniferum.	
		Epilobium palustre.	At the marsh near mire side.
		Eryngium maritimum.	On the sand by the sea side betwixt Prestonpans and Muselburgh.
	13.	Ligusticum scoticum.	By the sea side at Fase Castle den & east from ye Queens Ferry.

[1] This is a subsequent interpolation, and may be in Dr. Hope's writing.

[2] Last clause in Dr. Hope's writing. [3] In Dr. Hope's writing.

July 13.	Angelica sylvestris.	In Achendenny wood & all along the water side to Muselburgh.
	Chelidonium glaucum.	At Lumsden shore near Dunglass.
	Paris quadrifolia.	At a rivulet betwext East and West houses near Dalkeeth.
	Pastinaca sativa.	On the Breas west from Crail, Fife.
	Fumaria claviculata.	At Craigleeth Quarrys plentifully.
	Pisum arvense.	
	Vicia faba.	
14.	Atriplex laciniata.	
	Osmunda spicant.	In Achendenny wood. At the Hermitage.[1]
	Phalaris canariensis.	In the north Loch by a dich side.
	Alopecurus agrostis.	On the Bass Island.
	Agrostis spica venti.	Among Corns.
	„ stolonifera.	On wet sea sands.
	Arundo phragmites.	In Duddingstown Loch.
15.	Matricaria parthenium.	At Duddingstown Kirk.
	Artemesia absynthium.	At Dunbar, Bruntisland, &c: plentifully.
	Gentiana centaureum.	In a meadow not far from mire side.
	Plantago media.	At East Houses.
	Anchusa sempervirens.	In Dunglass Den in great plenty
	Tanacetum vulgare.	At mire side.
16.	Malva rotundifolia.	By Leeth walk.
	Plantago loeflingii.	By the way side betwext Ormistown & Haddingtown.
	Euphrasia odontites.	In the marsh at mire side.
	Arundo epigejus.	At the side of the same marsh.
17.	Cynoglossum officinale.	
	Marubium vulgare.	
	Ilex aquifolium.	Below Roslin by the water side.
	Fagus castanea.	In Dunglass Den.
	Epilobium angustifolium.	In Fase-castle den plentifully.
	Pimpinella saxifraga.	On Salisbury Craigs.
	Asperugo procumbens.	By Dunbar Church yard by the road side.
18.	Lycoperdon bovista.	
	„ pedunculatum.	
	Hedera helix.	On Salisbury Rocks.
	Veronica.	In Dunglass den.
	Arundo arenaria.	By the sea side.

[1] In Dr. Hope's writing.

July	18.	Lolium temulentum.	In the north Loch by the ditch side in the middle thereof.
	19.	Lavatera arborea.	On the Bass Island.
		Beta vulgaris.	On Do.
		Lithrum salicaria.	At Duddingstown Loch.
		Centaurea scabiosa.	Behind Goolen in a field.
		Anethum foeniculum.	At North Berwick.
	20.	Lysimachia tenella.	In a marsh west from Fisher-row.
		Parnassia palustris.	In the well known marsh at mire side.
		Sium nodiflorum.	
		Trifolium m. officinalis.	At Lufness mill by the burn side.
		Spergula nodosa.	In most marshes.
		Gentiana campestris.	East side of the Society at Hopt: house.
		Atriplex litoralis.	At Lufness mill by the burn side.
	21.	Scirpus acicularis.	
		Potentilla reptans.	
		,, verna.	On the craigs by Arthurs seat.
		Apium graveolens.	
		Leonorus cardiaca.	
	22.	Sedum telephium.	
		Campanula latifolia.	In Achendenny wood by the water side.
		Hydrocotyle vulgaris.	
		Cichoreum intybus.	
		Thlaspi campestre.	
		,, hirtum.	
	24.	Ranunculus flammula.	In marshes almost everywhere.
	25.	Asplenium marinum.	In Glass and weems caves.
	26.	Narthecium ossifragum.	In Bevely moss.
	27.	Lepidium latifolium.	On the breas at the back of St. Andrews.
		Hieracium.	With Do.
		Convolvulus.	With Do.
	28.	Asplenium scolopendrium.	On the rocks at Kenly burn, Fife, and at Dunglass Den.
		,, adiantum nigrum.	On Duddingstown craigs.
		Potomageton gramineum.	In Kenly mill burn.
		Myagrum sativum.	Among flax in Fife and other places.
	30.	Mentha verticillata.	
		Aster tripolium.	
		Pulmonaria maritima.	On Fifes ness plentifully.
	31.	Beta marina Hud.	By the sea side betwext Roome and Constantines cave Fife.
		Solidago virgaurea.	

Aug.	1.	Allium ampeloprasum.	At Cambo in a park, Fife.
		Ophrys palustris.	In a marsh east of Kenkell breas near St. Andrews.
	2.	Astragalus glycyphyllos.	In Bleba Den east from Coupar in Fife.
	3.	Sambucus niger.	On a rock in a den, north from Aughtermughty, therefore a native.
	7.	Ranunculus reptans.	At the north east side of Loch Leven plentifully.
	9.	Dipsacus fulonum.	In a Den west from Hopt: house.
		Thalictrum aquilegifolium.	In Dur.
	10.	Senecio aquatica.	In the marsh at mire side.
		Oenanthe fistulosa T. B.	
	12.	Convolvulus sepium.	
		Juncus squarrosus.	
	23.	Gcranium rotundifolium.	On the east side of Mr. Masons Garden.
	24.	Nepeta cataria.	
		Thalictrum flavum in seed.	
		Bidens cernua.	In the north Loch.
	25.	Pyrus malus.	
		„ communis.	East from the Queens Ferry at a park dyke.
	26.	Aethusa cinapium.	On the castle hill & by Leeth walk.
		Tordylium nodosum.	By Leeth walk.
		Lysimachia vulgaris.	
	27.	Rumex aquatica.	Without the Kings park in the rivulet y^{t} comes from ye Dukes walk.
		Triticum repens.	By the sea side on dry sand.
	28.	Bidens tripartita.	In the north Loch.
		Lepidium sativum.	Betwext Restalrig and the sea by a small rivulet.
		Triticum spelta.	In Corn fields.
		„ hibernum.	In Do.
	29.	Hordeum distichon.	In Do.
		„ vulgare.	In Do.
		„ hexastichon.	In Do.
	30.	Secale cæreale.	In Do.
		Cynosurus cristatus.	In meadows.
Sept.	3.	Hypochæris radicata.	Upon the road side on a dyke by a hedge as you enter ye Q: Ferry.
		Lichen calicaris.	
		„ cocciferus.	On the hills near to Reavelstone
		„ glaucus.	
Dec.	10.	„ vulpinus.	
		„ hirtus.	

Dec. 10.	Lichen deustus.	
	„ cornutus.	
	„ physoides.	
	„ globosus.	
	„ albescens.	Kings Park.
	„ paschalis.	On the castle hill rocks north side.
	„ calcarius.	
1765.		
Jan.	Lichen rangiferinus.	
	„ sanguinarus.	Kings Park.
	Bryum murale.	On walls.
	„ pyriforme.	On walls, stones and in the Kings Park.
	„ serpyllifolium.	At the water of Leeth near the new well.
	„ pulvinatum.	On stones in the Kings park.
	„ rurale.	
	„ aureum.	On the castle hill rock north side.
	Hypnum rutabulum.	
	„ filiforme.	
	„ lutescens.	
	Bryum pomiforme.	Kings Park.
	„ trunculatum.	
	Hypnum filicinum.	At the water of Leeth near the new well.
	Lichen fagineus.	
	„ ventosus.	
	Spongia oculata Hud.	On the sands of Leeth.
	Agaricus.	
	Tremella.	
	Clavaria pistillaris.	
	Boletus versicolor.	In woods on the stumps of Trees.

Here follows in the MS. a couple of blank pages, and the Calendar then resumes with a new heading as follows :—

A CALANDER OF PLANTS AS THEY WERE FOUND AND PREPARED IN THE YEAR 1765.

May 14.	Stellaria nemorum.	A little below the garden of Mavice Bank. Road side.
	Lathraea squamaria.	Below Mavice Bank near a small rivulet. Road side.
	Chrysosplenium alternifolium.	Below Roslin in the wood. Marshy Places. T. S.
	Phallus.	Above Leswede by the water side.
17.	Tussilago hybrida.	In Collintown wood on the N. side of the water.
18.	Symphytum tuberosum.	By the water of Leeth opposite to the new well

May 20.	Salix alba.	By water sides.
	Cerastium alpinum.	Near Goolen.
21.	Viburnum lantana.	In Dunglass Den.
	Helleborus viridis.	In Do.
	Lycoperdon epidendron.	At Dunglass on old Fir Roots.
	Fucus sanguineus.	In Caverns of the rocks within ye sea mark at Dun.
	„ piperitis.	At Do.
	„ ceranoides.	At the Black Rocks.
22.	Silene amoena.	On the sea Breas of Dunglass, Kinghorn. Crawmond Isl &c.
	Allium shoenoprasum.	In a Park on a mount near Fase Castle.
	Crambe maritima.	By the sea side at Lumsden shore near St. Abbs Head.
29.	Bryum fontanum.	In marches
June 1.	Boletus igniarius.	On the Root of a Tree near Trifichen.
	Satyrion viride.	On Moorish Ground north from Bancrief.
2.	Fumaria capreolata.	At the Hermitage and by way sides.
	Iberis nudicaulis.	By Jo. Williamson.
2.	Rubus Chamemorus.	On Campsey Fells & on every high Hill in ye Highlands.
7.	Galium parisiense?	In the Kings Park among stones.
12.	Dianthus deltoides.	At the Hermitage within the walls in the wood.
	Hieracium paludosum.	At Do. by the water side.
	Carex paniculata.	By a marsh a little to the south of Craig Lockart.
13.	Vaccinium oxicoccus.	In a large Marsh south east of Cross house.
	Rubus saxatilis.	Found in Penny cook wood, Auchindenny.[1]
	Peziza acetabulum.	In woods.
	Avena pubescens.	On Salisbury craigs.
18.	Fontinalis antipyretica.	In a rivulet north of Bancrief, W. Lothian.
	Salix pentandria.	Below Roslin on the north side of the wood.
22.	Orobus sylvatica.	At Lanfaugh by Dr Hope, also in the Island of Sky.
23.	Conferva rupestris.	In Roslin water above Roslin at foord upon stones.
26.	Ulva lynza.	By the sea shore on stones west of Leeth.
July 1.	Osmunda lunaria.	At Kersol Park near Carnwath by the Road side.

[1] In Dr. Hope's writing.

July 3.	Jasione montana.	Near Lenrick bridge in a wood and at Kilseith plent:
5.	Euonymus europaeus.	On Salisbury Craigs.
	Saponaria officinalis.	As you go from Collinton to Dreghorn by a Hedge.
6.	Sisymbrium irio?[1] an altissimum.	Near St. Bernards well on moist rocks.
7.	„ cheiranthoides.	By Jas. Robertson.
8.	Lichen cornucopioides.	On the wall of a large Park south east of Carnwath.
	„ filiformis.	On Do.
	„ spinosus.	On Do.
	„ globosus.	On Do.
	„ cornutus.	In Achendenny wood.
9.	Pisum marinum.	By the sea side near Roistown.
	Conferva plicata.	On shelves of the Rocks at Roistown in sea water.
	Lichen pustulatus.	In Dunglass Den by Mr. Urquhart &c.
12.	Byssus candida.	On Rotten Sticks
14.	Salix caprea.	In woods.
	Hypericum humifusum.	In Segby wood by the Road side, and near Micklour.
15.	Agaricus androsaceus.	In woods and groves among decayed Leaves.
	Lycopodium selago.	On Camsey Fells and other high grounds.
	Polemoneum cerulaeum.	Near Mr. Bells of Antremony.
16.	Scutellaria galericulata.	By the North side of Loch Coat Loch in gravel.
	Byssus incana.	Upon Peat ground in Camsey Fells &c.
25.	Oenanthe fistulosa.	In a Ditch by the Road side near the Plaisterers Fife.
31.	Saxifraga autumnalis.	In low grounds at Denhead and by rivulets in ye Highlands.
Aug. 1.	Rumex aquatica.	In a small Lake near Micklour.
9.	Lichen laciniatus.	On Stones going from Cushweil to Foss et v.v.
10.	Alchemilla alpina.	On Morther Hill and other mountains near Megerny.
	Galium boreale.	In a small Island of Lyon water at Megerny &c.
	Lycoperdon tuper.	In the Fir Park above Megerny Garden.
	Polypodium fragile.	In the Crivices of Rock on Migerny Hill at ye largest Hollow.

[1] This interrogation mark interpolated, and in Dr. Hope's writing, I think.

Aug 11.	Arbutus uva ursi.	On Migerny Hill & other high dry grounds.
	Trifolium.	A little above Megerny Fir Park & at Dunglass Summer H:
	Rumex digynus.	Amongst gravel in Megerny Fir Park &c: &c: there.
	Carduus helenoides.	In the Meadows at Megerny Plentifully.
	Vaccinium vitis-idaea.	Amongst the Heaths on Morther Hill &c:
	Lycopodium selaginoides.	On Morther Hill south of Megerny.
12.	Sparganium natans.	In the sides of Lyon water at Megerny.
	Salix.	In many places particularly on ye banks of ye Lyon at M[egerny].
	Lycopodium annotinum.	On the East side of a Hill which runs N. from M[egerny] Hill.
13.	Cornus suecica.	On the bank of a rivulet at ye west end of Morther Hill as also on the N: side of Megerny Hill but not in Flower.
	Saxifraga stellaris.	In the well eyes on the Hills of Morther Corilean & Megerny.
14.	Vaccinium uliginosum.	On Morther and the back side of Migerny Hills.
	Sphagnum alpinum.	In a well eye on the north side.
	Fontinalis minor.	Hanging from the Rocks of a Rivulet on Megerny Hill.
26.	Bromus arvensis.	Among wheat particularly near Abernethy.
27.	Osmunda crispa.	By Dr. R. Ramsay at Birnam Hill upon the Road side.
	Aira flexuosa.	In Moorish Grounds.
	Potomageton compressum.	By Jas. Robertson.
29.	Agrostis minima.	In pastures.
	,, capillaris.	In Do.
	Agaricus companulatus.	In Do. after Rain.
	,, muscarius.	On the Clay Know among Planting near Dunglass.
Sept. 5.	Mucor glaucus.	On Cattles Dung.
6.	Agaricus campestris.	In the Kings Park &c. &c.
7.	Boletus luteus.	At Dunglass and Alva among Planting.
9.	Bromus ramosus.	At the bottom of Dunglass Glen.
	Triticum repens.	At Do.
10.	Agaricus chantarellus.	In Dunglass Den South side thereof.

Sept. 10	Byssus velutina.	In Dunglass Den.
	„ antiquitatis.	In Do. on the Rocks.
11.	Bromus giganteus.	In Do. plentifully.
	Agaricus verrucosus.	In Do. scarce.
12.	„ mammosus.	At Dunglass among Planting.
13.	Byssus saxatilis.	In Dunglass den upon the Rocks.
	Polytrichum striatum.	On Trees in Auchendenny wood.
14.	Tremella hemispherica.	On the Fuci and Coralines at Dunglass.
	„ nostoc.	In pastures after rain.
15.	Rhamnus carthaticus.	In the Neighbourhood of Dumfrise by Mr. Crosby.
	Phellandrium aquaticum.	On the south side of Carsterfin near the Fortification in a ditch.
	Humulus lupulus.	On Do. near the well.
16.	Festuca elatior.	In the large meadow west of Carsterfen.
	Salix Helix.	In moist ground and Baulks betwext ridges.
	Phalaris arundinacea.	At the side of a marsh near mireside.
22.	Lysimachia vulgaris.	At the whim among ye Duke of Argiles Plantations in a moss.
29.	Briza minor.	In a bog at Woodeslee by Dr. Walker of Moffat.
	Bryum apocarpon.	In the Kings Park on Stones.
Oct. 30.	Convalaria majalis the withered remains.	At Blair of Athol on the Rocky banks of Tilt by Dr. Hope.

A Catalogue of British Plants in Dr. Hope's Hortus Siccus, 1768.

Arranged in the same order as in the Flora Anglica Huds. Ed. I.

This Catalogue is so constructed that there is room left for All Mr. Hudson's plants i.e. mentioned in the 1st edition.

☞ Denotes the plant not in Hudson.

* Denotes the plant not aborigenous but naturalized.

/ Denotes the plant has not yet been found in Scotland, and that the specimen I had from England.

? Placed after the name denotes that I am uncertain whether the plant is justly named.

‖ Added to the list since a list was sent Lord Bute, 1 Aprile, 1768.

o A specimen awanting.

F I R Figured by James Robertson.

Monandria.

	Salicornia herbacea	Aberlady, Castle Stewart near Inverness and Sky, in clay soil washed by the sea on the side of the forth opposite to Alloa.
/	fruticosa	from Mr. Bryant.
	Hippuris vulgaris	common in Lakes and ditches.
	Callitriche verna	in Do. and rivulets.
	autumnalis	in Do.
	var.	

Diandria.

	Ligustrum vulgare	in the banks of the river at Roslin.
/	Veronica spicata	from Mr. Bryant.
	hybrida ?	1767 seems a variety of the arvensis and is placed with it.
	officinalis	a frequent plant in dry pastures all over Scotland. e.g. Kings Park.

/ Veronica fruticulosa		
	serpyllifolia	frequent in moist Pasture ground and banks of Rivers e.g. at St. Bernards Well.
	Beccabunga	in rivulets and ditches very frequent.
	Anagallis	in Do. at Lochend not so frequent as the former.
	scutellata	in Lakes and Ditches not very frequent grows in the North Loch Carron.
	chamaedrys	a frequent plant in dry ground and General.
	montana	in the woods (under deep shade and moist ground) of Hamilton Auchindinnie.
	arvensis	On old walls, corn field, on the way side frequent here, not general.
	var.	
	agrestis	corn fields frequent on the way side, not a general plant.
	hederifolia	chiefly among the wheat, J: R: seldom has seen it but in the neighbourhood of Edin.
i	triphyllos	Mr. Smith 81.
☞	alpina	from Dr. de la Roche & Messrs. Fabricius 1767 Ben Nevis.
	fruticulosa	Ben Nevis.
	verna	Mr Smith 81.
Pinguicula vulgaris		in moist ground a general plant over Scotland.
/	villosa	Mr Hudson 1768.
	lusitania	in moist ground twixt Irwin & Air & plentifully in Isld. Lamlash near St. Moly's Cove. J. R.
Utricularia vulgaris		in a ditch near Goollen Loch east of Aberlady.
‖	minor	Ja. R. 1768—copiose in Sky in a loch a mile west of Sligachan.
‖ Verbena officinal[is]		twixt the toll & Innerkeithing on the road side.
Lycopus europaeus		in Arran, at Inveraray J. R., at Craigens by the side of Loch Gyle A. F.
Salvia pratensis		I had it from Aberdeen, Kirkmichael, Taymouth, Sky, not in the neighbourhood of Edinburgh.

	Salvia verbenacea	on Salisbury craigs, not yet found elsewhere.
	Circaea lutetiana	in woods, a general plant.
o	alpina	Hamilton wood
	Anthoxanthum odoratum	frequent in dry pastures and general.
	Bufonia	

Triandria.

	Valeriana officinalis	in woods, side of rivulets. rocks on the sea side particularly in Caithness a general plant.
☞ o	Pyrenaica	in a ditch on the south side of Pentland hills.
	dioica	Mr Burges & Mr Badenoch at Langholme.
☞ * o	rubra	found by Mr Menzies of Cults at Oliver Cromwells Castle at Inverness 1767.
	Locusta.	frequent in corn fields dry banks a general plant.
·	Crocus	
o	Iris Pseudacorus	in wet ground a general plant mark of a strong soil.
/	Foetidissima	Mr Smith.
·	Schoenus Marisicus	Mr Bryant.
	nigricans	on this side Berwick in Bute, Arran, in marshes near the Sea.
‖	compressus	in Arran on the sea side near the Castle of Brodwick.
	ferrugineus	in Sky.
	albus	a very frequent plant in the North & West wet moors.
·	Cyperus longus	
	Scirpus palustris	a general plant in the Lakes of Scotland.
	cespitosus	not a more General plant than this, in Moors.
	acicularis	in marshes.
	fluitans	in Stagnating water at Grey Crook Bute.
	lacustris	frequent in Lakes.
	setaceus	in moist places e.g. at St. Bernards well.
/	mucronatus	
	maritimus	Port Laing east of N. Ferry in Arran Bute Sky & Mull near (*at*) the Seaside.
	sylvaticus	at Roslin Loudoun House moist ground.

	Eriophorum polystachion	a general plant in Mosses.
	vaginatum	Do.
☞	‖ alpinum	I am uncertain from whence it came or where it was found.
	Nardus stricta	a frequent plant in dry barren pastures and general.
*	Phalaris canariensis	
·	arenaria	Dr Pultney est Phleum arenarium Lin.
·	phloeoides	81 Mr Smith.
o	arundinacea	in wet meadows not very frequent A. F.
·	Panicum viride	
	dactylon	Mr Lightfoot.
* ·	sanguinale	Mr Lightfoot.
* ·	crusgalli	Mr Lightfoot.
·	miliaceum	
o ·	glaucum	
/	verticillatum	Mr Smith.
	Phleum pratense	in meadows and way side A. F. not in the north nor west J : R : confer specimina.
	nodosum	in meadow & pasture fields A. F.
	arenarium	
	Alopecurus pratensis	in meadows A. F.
	agrestis L.	My[o]s[u]ro[i]des. Huds.
	geniculatus	in wet ground.
/	ventricosus	Mr. Smith.
·	bulbosus	Mr Lightfoot.
/	aristatus	Mr Smith.
·	Stipa pennata	
	Dactylis cynosuroides	ubique in siccis e.g. in Mr. Alston's Quarry on the Calton hill.
·	glomeratus	
·	Millium effusum	in a den in a wood belonging to Mr Wemyss near South Wemyss east end of Fife A. Menzies June 78.
	Agrostis spicaventi	
	canina	
·	rubra	from Mr Hudson.
	stolonifera	
	capillaris	A. F's Cat.
·	minima	from Mr Hudson.
	Aira cristata	in dry pastures a pretty General plant it is made (Poa cristata).
	coerulea	the principal grass in all the wet moors over Scotland. Melica coerul[ea] Linn. Mant.

	Aira aquatica	in the North Loch.
	cespitosa	in moist ground and under cover.
	flexuosa	in dry fields pretty general.
/	montana	Mr Smith.
/	canescens	Mr Smith.
	praecox	
	caryophyllæa	in dry sandy soils a general plant.
	Melica nutans	in moist woods Hamilton wood.
/	montana	Mr Smith.
	Briza media	in pasture ground not a general plant.
·	minor	fm. Mr. Lightfoot.
	eragrostis ?	non an Uniola.
	Poa aquatica	in Stagnated water below Cannon mills not a general plant.
	trivialis	in pasture grounds & by the way sides pretty general.
	several var.	
	pratensis ?	in the meadows at Corstorphin A. F. cat.
	compressa	A. F. cat. Mr Bryant on wall heads & old walls. Mr Ur[quhart] collect.
‖	angustifolia	July 1769.
·	bulbosa ?	Dr Pultney.
·	setacea	Mr Bryant.
	annua	in pastures near cultivated ground & way sides.
·	nemoralis	Dr Pultney.
	maritima	west of Royston.
	rigida	on Salisbury hill Mull & Sky.
o ‖	loliacea ?	in Bute & this neighbourhood Aberdeen on Sandy beaches.
☞	alpina	Ben Crooken by Mr Oaks in 1767 on whose authority I insert it.
	Festuca ovina	in dry pastures & hills a general plant.
	vivipara	in moist ground not a frequent plant.
	duriuscula	in dry pastures & hills a general plant.
·	bromoides	A. F. in pastures.
	myuros	ad muros e.g. twixt Abbyhill & Restalrig.
	pratensis	
	elatior	in meadows.
	decumbens	by Jo. Williamson North ferry Hill Cramond Island.
	fluitans	in stagnating waters a general plant.

	Festuca sylvatica	
☞	uniglumis Solander.	fm. Mr. Lightfoot.
	Bromus secalinus &	
	var. hordeaceus	in cultivated grounds road sides a general plant.
	arvensis ?	in a corn field on this side abernethy.
/	erectus	Mr Lightfoot.
‖	mollis	road side. This plant passed for the secalinus.
/	ciliatus L	
	sterilis	way side, hedges, not a general plant.
	giganteus ?	in the den at Dunglass & in woods.
	ramosus	between Bruntisland & Aberdour.
	pinnatus	in the Den of Dunglass & in woods.
	Avena species nova	
*	fatua	
	pratensis	in dry pastures.
*	nuda	from Mr Lee.
	pubescens	Ja: Ro: author. On the south side of Brede in dry ground.
	elatior	in pastures meadows corn field a frequent & General plant.
	flavescens	on Salisbury Craigs Mull & Sky in dry ground.
	Arundo phragmites	in Lochs a general plant.
·	calamagrostis	
o ‖	epigyjos	Myreside.
	arenaria	in sandy ground—along the shore around the island in Mul Arran but not Sky there is no sand in Sky.
	Lolium perenne	in pastures way side a general plant.
o	temulentum	in Corn fields.
	bromoides	
	Elymus arenarius	in sandy ground on the coast of Air Bute J. on. Caithness Sutherland not in the neighbourhood of Edinburgh.
	Triticum repens	in & near cultivated ground a general plant.
	caninum	Hudson.
☞	maritimum Mantiss. p. 325.	Mr. Lightfoot.
	junceum	in sand along the shore a general plant around the Island.
	hybernum	

Hordeum murinum	at the foot of walls on the road side.
distichon vulgare	
marinum	Mr Smith.
pratense	Mr Smith.
sylvaticum	Mr Smith.
Secale cereale	
villosum	Hudson. est Hordeum non descr.
Cynosurus cristat[v[s	in dry pastures a general plant.
echinatus	
coeruleus	Mr Lightfoot also 1771 by J. R.
paniceus	
Holosteum umbellatum	81 Mr Smith I had it long ago from Mr Bryant.
Montia fontana	in springs & rivulets.
☞ Polycarpon tetraphyllum	Mr Lightfoot.

Tetrandria.

Dipsacus fullonum	in the wood at Hop[e] House.
silvestris	on the road to Alva from y[e] North ferry J. Williamson.
pilosis	Mr Alchorne.
Scabiosa arvensis	in pasture & corn fields not a very general plant.
Succisa	in pasture & meadows a general plant.
columbaria	Mr Bryant.
Centunculus minimus	on the west of Fisherrow in moist sandy ground.
Plantago major	in pastures & by the way side a general plant.
media	on the road side up from the New South bridge of Dalkieth.
lanceolata	in pasture & meadow ground way side a General plant.
var. loeflingii ?	seems to be the maritima.
maritima	on the sea beach and on high hills a general plant.
montana Hudson	by Ja: Robertson & before by A. F.
coronopus	in dry ground and frequently by the sea side a general plant.
uniflora	in water or by the verges of water the island . . . in Shetland is all over covered with it.
Sanguisorba officinalis	in a gravelly soil on Mofat water two miles from Mofat, said to grow in Craigie hall parks.

	Rubia anglica	Mr Hudson.
☞	tinctorum	Mr Lightfoot 1773.
	Sherardia arvensis	in dry pastures not a general plant.
	Asperula odorata	in dens & woods a general plant.
	cynanchica	Mr Alchorne.
/	arvensis	Mr Bryant.
	Galium verum	in sandy ground a general plant.
	mol[l]ugo	in the Gallowlee park near the sand pit.
	montanum	on hills a general plant on the top of Hartfelt.
	uliginosum	in moist pastures.
‖	erectum ?	Mr Menzies.
/	a new species	sent by Dr Freer from London but whether he carried it up I dont know.
	palustre	in Lochs a general plant e.g. Duddingston Loch.
	Aparine	in hedges & ruderatis a general plant.
/	parisiense	
	boreale	on the sides of rivers a general plant.
☞	* Epimedium alpinum	at Castle Downie by Mr Menzies said to grow near Glasgow Dr Irwin.
	Cornus sanguinea	Mr Burgess.
F.I.R.	herbacea	on high mosses to a north aspect general plant North of Inverness, at Inveraray & Megerney.
	Alchemilla vulgaris	in pastures & meadows a general plant & banks of Rivers.
	minor	on the road from Bathgate A. F.
	alpina	in the North of Scotland a frequent plant on high hills not in the neighbourhood of Edinburgh.
	Aphanes arvensis	in dry pastures in the neighbourhood of Edinburgh.
	Bufonia	
	Potamogeton natans	in slow moving water a general plant.
	var.	
	perfoliatum	in Lochs e.g. Duddingston Loch and in Bute.
	lucens	in Lochend in Bute.
	2 var.	
	crispum	in ditches & rivers.

Potamogeton densum		in Duddingston Loch March 1770 what was taken for the serratum is truly the densum & what the serratum is I know not. Linnæus gives it up in the Syst. Nat. ed. xii. [1]
	compressum	found in Loch Skaill Orkney & in south Ronaldshaw & on the banks of the Tay.
	pectinatum	in Duddingston Loch & in south Ronaldshaw.
	gramineum	in Loch Greennon Bute 1768 Ja: Robertson in Loch Skaill.
/	pusillum	Mr Alchorn.
	marinum	of a large size in a fresh water Loch near Ure Northmaven Zetland.[2]
	marinum	Mr Bryant & in the Loch of Stennis Orkney.
‖ Ru[p]pia maritima		J. R. 1768 in a salt marsh (F.I.R) to the south east of new Kelso head of Loch Carron opposite to Sky.
‖	elongata	J. R. 1769 Orkney Loch Stennis at the bridge of Brogar.
Sagina procumbens		in pastures a frequent plant & general.
/ erecta		Dr Pultney.
/ Tillaea muscosa		Mr Bryant.
Ilex aquifoli[um]		in the isle of Mull plentifully: in Inch maree of an enormous size (but not measured) Pennant Hebrid. p. 330.

Pentandria.

Myosotis scorpioides & var. d.		in dry & in wet ground a General plant.
Lithospermum officinale		plentifully twixt Auch and Rosemarchie on dry ground.
/	purpuro-coeruleum	Mr Lightfoot.
	arvense	inter segetes east of Braid, dyes the paper a purple.
Anchusa sempervirens		in the Den at Dunglass plentifully on Cramond water & some other places.

[1] The name "serratum" is scored out and "*densum*" is substituted in the Catalogue: hence the note.

[2] This name replaces one previously given and erased: hence the doul le entry of the species.

Cynoglossum officinale	along the Sea side from Dunbar to Queensferry at Saltown Lymekills.
omphalodes	in a wood near Glasgow Dr. Irwin.
Pulmonaria maritima	along the Seaside a pretty general plant but not one twixt Berwick & Lieth.
Symphytum officinale	along the rivulet from the watering place at the kings park & at Lithgow.
tuberosum	from Coltbridge downwards the water of Lieth.
* Borago officinalis	near Bruntisland and in Aberdeenshire Dr Skene.
Asperugo procumbens	at Dumbar at Cromarty and at Fortrose near Inverness.
Lycopsis arvensis	inter segetes ubique.
Echium vulgare Lin.	In the kings park, at Inveresk & many other places in dry ground.
(anglicum H)	a new species or variety on the road from North ferry to Alva.
Primula vulgaris	on the sides of rivers woods and moist places all over Scotland.
veris	on Salisbury Craigs.
var.	
F.I.R. farinosa	along the coast of Caithness & Strathnaven in moist pastures.
Menyanthes trifolia[ta]	in marshes evry where.
/ Nymphæoides	
/ Hot[t]onia palustris	Mr Bryant.
Lysimachia vulgaris	at the wheem, in a wood at Larg Sutherland in moist ground.
th[y]rsiflora	
nemorum	Auchindinny wood & in many other places of Scotland in moist ground.
Num[m]ularia	1769 Mr Jo: Huggan on the banks of Taras water parish of Canaby.
tenella	in moist pastures pretty general in Caithness twixt Cansbay & Dunsbay head a small plain covered with it.
☞ F.I.R. Azalea procumbens	plentifully on a hill in Glen Criven on Scaraber Caithness on benevalich sutherland &c.
Anagal[l]is arvensis	inter segetes a general plant.

Convolvulus arvensis	all the plants in this neighbourhood are multiflorus J. R. says he never found any uniflorus but in the Links of Air—on a dry soil.
sepium	at port Laing North ferry, in Arran, Bute, Mull, Sky, dry soil.
soldanella	on the Carrick shore plentifully in sand.
/ Polemon[i]um caeruleum	
Verbascum Thapsus	at Hopetoun House parks at Bethaick in Bute & at Brede dry soil.
/ Lychnitis	1771 Mr Lightfoot.
Vinca minor	in Colinton wood but more plentifully at Brede & Cramond water dry soil.
Hyoscyamus niger	on Lieth walk, Salisbury craigs, Icolumb Kill.
/ Datura	
Solanum nigrum	on the Carrick shore near the Coves.
dulcamara	a frequent & general plant in hedges.
Atropa bella-donna	at Borthwick castle, at Icolumb: kill, park of Stirling.
Samolus valerandi	in a marsh near Dirleton East Lothian, Carrick shore, Mull, Arran.
Lonicera pericl[y]menum	a frequent plant in woods.
Campanula rotundifolia	ubique on rocks and dry pastures.
many varieties	
/ patula	Mr Pultney.
/ rapunculus	1771 Mr. Lightfoot.
?	not ascertained it is growing in the Garden.
latifolia	in woods a pretty general plant.
Trachelium	Auchincrue.
glomerata	Aberdeen shire Dr Skene & by J: Robertson 1767 at . . ., twixt Kinghorn & ye ferry. J. Lind, viz twixt Kingn & Pettycour 84. J. Hope.
/ hybrida	Mr Bryant.
hederacea	1771 J. R.
/ Phyteuma orbicularis	
R[h]amnus Frangula	near Dumfries Mr Crosbie.
Euonymus europaeus	Salisbury nowhere else.
Ribes rubrum	plentifully in an island of the Crooked Loch Assynt.

*	Ribes alpinum	Ja : Robn. 1768 in Hamilton wood.
	grossularia	in Salisbury and several places.
	Hedera Helix	Kings park & elsewhere on trees walls and rocks.
/	Illecebrum verticillatum	Dr Pultney.
	Glaux maritima	evry where on the Sea shore.
/	Thesium Linophyll[um]	Dr Pultney.
/	Swertia	
/	Gentiana Pneumonanthe	Mr Bryant.
/	amarella	Dr Poultney.
	Centaur[i]um	in dry & sometimes in moist pastures a general plant.
	campestris	in pastures a general plant.
/	filiformis	Dr Poultney.
*	Cuscuta europaea	on a furze, on Lint cheifly in the west.
	Chenopodium Bonus-	on way sides (an urban plant)
	Henricus	Queensferry Bute.
	urbicum	Nor Loch, Mull & Sky.
	murale	in agris & ad vias.
	hybridum	in the Nor Loch A.F.
	album	in agris a general plant.
	glaucum	
/	serotinum	Mr Alchorne.
	vulvaria	in hortis nimis frequens near Kirkbraehead.
.	botrys	Mr Bryant.
	maritimum	in salt marshes near barnbougle castle to y^e^ east.
	Salsola Kali	in sand on the Seashore.
/	fruticosa	Dr Poultney.
	Beta vulgaris	on the Bass A. F.
o	maritima	near Largo in fife A. F. confer his letter from Lond. Jan. 1768.
/	Herniaria glabra	Mr Alchorne.
/	hirsuta	Mr Alchorne.
o	Ulmus campestris	in Sutherland & Assynt on precipices where there never had been plantations, wich elm Pennant hebrid. p. 328.
	Eryngium maritimum	on this coast in sand IColumb : kill Carrick.
	Hydrocotyle vulgaris	in marshes every where a general plant.
	Sanicula europaea	in woods a general plant.
/	Bupleurum Rotundifolium	Mr Smith.
/	tenuissimum	Mr Bryant.
	Tordylium nodosum	in this neighbourhood on Leith walk, the Dukes walk.
/	officinale	Mr Smith.

/	Echinophora spinosa	Mr Lightfoot from a garden.
/	Caucalis arvensis	Mr Bryant.
	anthriscus Hudson	around Edinburgh viz on Lieth walk, in Sky ad vias & in sepibus.
/	latifolia	Mr Smith.
	leptophyllos	Mr Lightfoot.
/	Daucoides	Mr Smith.
	Daucus carota	on dry soils a general plant.
	Conium maculatum	an urban plant pretty general J: R. did not find North of Inverness except at Thurso the Œnanthe crocata is taken for it & used.
	Athamanta Meum	in dry pastures among the Hills of Perthshire &c. Tweddale.
/	Peucedanum minus	Mr Hudson 1767 confer specimen sent by Mr Lightfoot.
/	officinale	Mr Smith.
‖	Crithmum maritimum	1768 Jo: Naesmyth MS on precipices over the Sea at the mouth of the River Dee near Kirkcubright on each side east & west.
	Heracleum Sphondylium	in pascuis et ad vias.
	Ligusticum scoticum	on the Seashore twixt [word omitted] & Boness a general plant on the Coast.
o	Angelica sylvestris	in shady moist places of woods a general plant.
/	Siùm latifolium	Dr Poultney.
/	nodiflorum	Mr Bryant.
	erectum Hudson, angust. Lin.	in Loch and rivulets a general plant.
	repens	on the sides of the pond west of Fisherrow by roadside and on Gullon Links. F. H.
/	Sison Amomum	Mr Smith.
/	segetum	Mr Bryant mistake.
	verticillatum	near Air and plentifully in meadows on the Shore at Ruthwell. J. Burgess.
	inundatum	in ditches & ponds a general plant around Edr. in Bute.
	planta ignota	transferred to Sium.
	Oenanthe fistulosa	in moist ground at the Northend of the hill at North ferry on the road side.
	?	Mr Bryant error confer specimen.

o Oenanthe crocata — in moist ground a general plant in a ditch east of Abbyhill.
Bunium bulbocastanum — in arvis & pascuis ubique a general plant.
‖ Seseli ceruifolia — in a park at Auchincrue est Sison verticillatum.
/ pumilum — Mr Lightfoot.
Cicuta virosa — Loch End.
Phellandrium aquaticum — in a fossé around an old Castle ¼ mile South of Corstorphin.
Æthusa Cynapium — in arvis.
* Coriandrum
Scandix Pecten — in arvis, in the North, in Mull, in Sky.
Anthriscus — ad vias around Edinburgh.
Chaerophyllum sylvestre — ad vias around Edr. Bute.
temulum — ad vias a general plant.
* Pastinaca sativa
Smyrnium Olusatrum — West Church Coltbridge, plentifully near the Coves Carrick.
o * Anethum foeniculum
o * Carum carvi — in pascuis a general plant.
Pimpinella saxifraga — Mr Alchorne.
major — Musselbro Links, & plentifully at Currie Craoie in Arran in moist ground.
Apium graveolens
* petroselin[um]
Ægopodium Podagraria — ad sepes in hortis antiquis a general plant.
o * ? Viburnum Lantana — in the Den of Dunglass.
Opulus — in Auchindinny wood, in Sky & frequent in the woods of Argyleshire & in a glen near Greenlaw Mr Hud[son].
Sambucus nigra — ad pagos Salisbury Craigs, western isles, (Islay Mr Menzies).
Ebulus — at the Mans of Duddingston, at Pentcaitland in wet ground on the road to Dalkeith 2 miles from Edinr.
o * Staphylea pinnata — at Hamilton.
Alsine media — ubique in umbrosis cultis.
var.
Parnassia palustris — in moist pasture ground general plant (Stamina!) at the 11th mile stone on road to Noble House.
Statice Armeria — a maritime & alpine plant and general.

	Statice Limonum	(Mr Bryant) fm S[r]. Ja: Nasmyth wh had fm Galloway 1775.
/	reticulata	Mr Bryant.
*	Linum usitatissimum	in arvis.
	perenne ?	
	tenuifolium	Mr Sandeman.
	catharticum	in dry pastures a general plant.
	Radiola	at fisherrow in moist ground.
	Drosera rotundifolia	in Mosses a very general plant.
	longifolia	in Mosses cum priore but not so frequent.
/	Anglica	Mr Smith 81.
	Sibbaldia procumbens	Ben Lomond Ben Nevis & several alps. (by Mr Huggan).
/	Myosurus minimus	Mr Bryant.

Hexandria.

*	Berberis vulg[aris]	North berwick Law, Myreside, at Dunrobbin in Ditches.
/	Frankenia laevis	
	Allium Ampelopras[um] ?	
	arenarium	in an inclosure belonging to Mr Charteris near St. Andrews.
	vineale	Kings park & around Lochend to the East.
	ursinum	in woods a general plant.
	. . . ?	J. R. 1767 was assured a garlick grew in Caithness twixt Langal & Dunbeath, ye Revd Mr Stewart says the schoenoprasum grows in Arran.
/	Bulbocodium	
/	Narcissus	
o *	pseudonarcissus	In the parks at London.
	Hyacinthus non-scriptus	in the Kings Park & in woods a general plant.
F.I.R.	Scilla bifolia ?	grows on. the coast of Carrick & Cantire & plentifully near Tongue & in Shetland.
/	autumnalis.	Mr Alchorne.
/	Ornithogalum luteum	Mr Kyle 1771.
/	Ornithogalum	
/	Fritillaria	
/	Asparagus	
o	Convallaria majalis	at Blair of Athole on a bank of the river.
o	multiflora ?	I was told either it or polygonatum grew in Callander wood.

F.I.R. Anthericum calyculatum — in a glen near Glen More Ross shire & in a moor near Ben Grihum Sutherland.

Narthecium ossifragum — in mosses a general plant.
Peplis Portulaca — in stagnis.
/ Acorus Calamus — Mr Kyle 1771.
Juncus acutus — in Bute & Arran on the sea shore.

conglomeratus — around Edinb. in wet ground & in Arran.
effusus — in moist ground & marshes a frequent and general plant.
inflexus ? — around Edinb. in moist pastures a general plant.
triglumis — J R 1771, Mr Yaldon Ben Lomond 75.
squarrosus — on hills & moors a general plant the Rad. leaves keep down every thing around it.

articulatis — in wet pastures a general plant.
bulbosus Linnæi — confer specimina.
Hudson — confer specimina.
bufonius — ad vias a general plant.
biglumis — Mr John Stewart.
pilosus — in Auchindinny wood.
sylvaticus — in woods shady dens North side of hills a general plant.
campestris — in pascuis ubiq.
var. 6 — in moist heaths on the road to Alva from Northferry.

Some other varieties if not new species.

Triglochin palustre — in a marsh at Myreside and in several other moist clay grounds a pretty general plant.
maritimum — a general maritime plant in wet ground.

Rumex . .. ? — in septo regio.
o acutus — in incultis a frequent & general plant but not in high ground.
crispus — ad vias in pascuis et on the Sea shore a general plant.
obtusifolium ? alpinum ? — within $\frac{1}{8}$ mile of Mofat on the road side & at Portsoy Banf shire.
/ pulcher — Mr Bryant.
/ maritimus — Dr Pultney.
o Britannica — plentifully at Loch Miclour.
digynus — on several of the high hills of Scotd. Mull & Sky plentifully.

Acetosa — ad vias & pascuis a general plant.

	Acetosella	in arvis & pascuis arenosis a general plant.
* ?	Colchicum autumnale	in a wood sandy Hall Caroline Park.
	Alisma Plantago	in aquosis a general plant at Lochend Hope Park.
	ranunculoides	at Myreside in ditches in Bute.
	natans	Mr Lightfoot.
/	Damasonium	from Mr Bryant.

Heptandria.

F.I.R.	Trientalis europaea	in most woods of the North.

Octandria.

	Epilobium angustifolium	on banks of Rivers on Rocks at the Sea side in dens of High hills in many places of the North of Scotd. in Mull & Sky.
	hirsutum (Hudson)	in the Nor: Loch and in the neighbourhood of Edinb.
	ramosum	Hudson.
	montanum	a frequent General plant.
	tetragonum	in Aberdeenshire Dr Skene, Arran and Bute.
	palustre	in sides of Lochs & rivulets a general plant.
	Several varieties & a new species ?	
	alpinum	Ben Buy. J. R. 1766.
	Vaccinium Myrtillus	in ericetis & silvis a general plant.
	v[ar]. fructo albo	in an Oak wood at Dunkeld from the Duke 1771.
	uliginosum	in silvis & ericetis of the North.
/	cantabricum	
	Vitis-idaea	in silvis & ericetis in a wood at Dalnagarie near Inverness plentifully.
	Oxycoccus	in Bevely moss south side of Pentland hills at Glencorse, great fields of it near Dumfries Geo Clerk.
	Erica vulgaris	
	var. flore albo	
	var. B. Lin.	1768 Sir Ja. Naesmyth.
	cinerea	
	Tetralix	
/	multiflora.	Mr Aiton 1771.
	Daphne Laureola	in Roslyn wood, at the Coves in Carrick.

/ Blackstonia perfoliata
Polygonum Bistorta — at the old Castle ruins South of Corstorphin, a little east of Roslin Chapel.
viviparum — in pascuis montosis in the North of Scotd.
amphibium — in Lochs & Ditches & in dry grounds adjoining.
v[ar]. terr[es-tre]
Persicaria — ubique a general plant.
var.
Hydropiper — in moist ground a general plant.
/ minus — Dr Poultney.
aviculare — ad vias ubique.
several varieties.
Convolvulus — inter segetes a pretty general plant.

F.I.R.Adoxa Moschatellina — in silvis & umbrosis.
Paris quadrifolia — Bethaick Den & at west houses south of Dalkeith.

/ Elatine Hydropiper

Enneandria.

/ Butomus umbellatus — Mr Bryant.

Decandria.

Monotropa Hypopithys — by Mr Oaks 1767.
Pyrola rotundifolia — in Auchindinny wood, on the heaths near Dalnagarie near Inverness.
minor ?
F.I.R. secunda — in a wood opposite to Moy Hall Inverness & in several places of Ross-shire.
uniflora
‖ Andromeda polifolia — in the large moss 1768 by Jo Williamson at Blair Drummond.

F.I.R.Arbutus alpina — Ben Grihum & several hills in Sutherland.
Uva-ursi — near Drummelzier, in all the dry heaths of the North.

Chrysosplenium
oppositifolium — ad Scaturigines in Silvis.
alternatifolium — in Roslin wood in moist places sed rarius, in Fife Mr Jo. Storer.

Saxifraga	stellaris	in springs and rivulets on the high hills of the North.
	nivalis	Ben Buy Mr Oakes 1767, J: R: 1766 to a Nor east aspect in Mull & Sky, and on the hill of Lars Mr Stewart. B. Lomond.
	oppositifolia	on Ben Buy, on the Rocks along the seaside at Tongue, in Mull & Sky.
	aizoides ?	I had a plant under this name from Dr Walker 1765 but I am doubtfull whether it is it or not.
	aizoides ?	Dr Poultney.
	aizoides	in all the rivulets of the hills in the North pretty frequent plant.
F.I.R.	trydactylites	all along the coast from Cromarty to Dunrobbin in sand, on breads hills & Craiglochart.
	granulata	in pascuis siccis in silvis ubique a general plant kings park.
	hypnoides	both a maritime and alpine plant along the Coast from Ord to Langal & among stones on the high hills.
/	Geum	fol. subrotundo majore pistillo floris rubro Ray syn. 355.3. Dr Bard said that he found it plentifully on the hills twixt Inveraray and Taymouth.
	a new species 1771.	
Scleranthus	perennis	around Edinburgh, 1768 by James Robertson near Irwin.
	annuus	in pascuis & locis arenosis.
‖	Polycarpos	Mr J. Huggan 1767 near Langholme at broomholme on a road side.
o	Saponaria officinalis	at Bethaick in Aberdeenshire Dr. Skene.
Dianthus		
/	prolifer	Mr Bryant.
	deltoides	on the high road to Laswade on this side.
	glaucus	at Brede Lochend in pascuis montosis aridis has not been [seen ?] except in the neighbourhood of Edinb.
/	arenarius	1771 Mr Lightfoot.
Cucubalus		
	Behen	ad vias & in arvis frequens circa Edinam not a general plant.

	Cucubalus viscosus ?	at Dirlton East Lothian.
/	otites	Mr Aiton 1771.
	acaulis	on stoney high hills of the North & west, Mull & Sky.
	Silene cerastoides	at Luffness Mill, on Musselburg water at East Park.
	amoena	a maritime & alpine plant frequent & General.
	quinque vulnera	Mr Bryant.
/	nutans	Mr Smith.
	noctiflora	ad vias & inter segetes circa Edinam.
	armeria	on Lieth water above Coltbridge.
/	anglica	Mr Alchorne.
	Stellaria Holostea	in silvis & dumetis a general plant.
	graminea	in solo arido viz. Kings Park A. F.
	var. y. edit. prim Sp. Plant.	at Duddingston Loch side where the boat is fixed.
	biflora	at Alva error vid. specimen conf. Spergula saginoid[es].
	nemorum	A. F. catalog., in Mavisbank wood, & Mr Burgess.
	Arenaria peploides	in sand or among Stones every where along the seashore a generall plant.
	trinervia	in the wood twixt Red Hall & Collington.
	serpyllifolia	in arenosis aridis passim.
	verna	S.N on the rocks in the Kings park, Sky, not a general plant.
o	laricifolia ?	in Carrick, Arran and near Tongue, Aberdeenshire Dr Skene.
/	tenuifolia	Mr Alchorne.
	rubra & var. marina b	in clay soil on the sea side a general plant.
	var. a staminibus octo	in dry ground sometimes near the former.
	Cherleria sedoides	J. R. 1766.
	Cotyledon umbilicus	along the coast of Carrick Bute and Arran.
	Sedum Telephium	on Musselburg water, Port Laing North ferry ; Bute Arran among stones.
‖	atratum.	by Mr Huggan at Taras near [word omitted] Sept 1769.
	reflexum	at Gray Crook along a wall.
o	rupestre ?	A. F. Cat. on the walls of the Cathedral Church of St Andrews A. F.

	Sedum album	on the hill above the House of Alva.
	acre	in stonny places a pretty general plant Kings Park.
‖	sexangulare	1768 J. Rob. error est annuum. Mr. L. on the road twixt Loch Drummore & Landhouse copiose, Bute Arran Mull & Sky.
/	annuum	
/	dasyphyllum	Mr R. Stevenson 1771.
	villosum	on the high road on the top of Ericstone brae, on the south side of Pentland Hill, Bute.
	Oxalis acetosella	in silvis passim a general plant.
	Agrostema Githago	inter segetos circa Edinam Bute & Arran.
	Lychnis Flos-cuculi	in locis humidis a general plant.
	viscaria	Salisbury craigs, Den of Bethaick.
	dioica	in silvis in pascuis a general plant.
	Cerastium vulgatum	in pascuis & ad muros (it sports in its habit in loco humido folia sunt latiora rotundiora et flores colliguntur in capitulum J : R.)
	many varieties.	
	viscosum	Calton hill, twixt Leith & Restalrig.
	semidecandrum	twixt Newhaven and Caroline Park, Bute & Arran.
	arvense	what we had for this plant is the repens Lin. I don't know whence I had it.
/	arvense	from Mr Bryant ?
	alpinum	on Ben Lawrs Archd. Menzies.
	tomentosum	Collinton Wood, on Ben Buy west of Taymouth near ye Summit ? Oaks ; was it not the latifol[ium] Lin. wh he found there ?
/	aquaticum	
/	umbellatum	Mr Smith.
	Spergula saginoides	1766 South of Air, 1767 in Lord Raes country, 1769 plentifully at Ilesburgh & Helwick in North Maven Zetland.
	arvensis	inter segetos.
	pentandria	on the road near Whitburn.
	nodosa	
/	laricina	Mr Smith in pascuis humidis a pretty general plant.

	Spergula	? In Sky J R 1768 among Lint a twining species wh seems to have all the characters of the arvensis.

Dodecandria.

o /	Asarum europaeum	
	Lythrum salicaria	at the side of Duddingston Loch, plentifully in Airshire Arran Bute Mull and Sky and all the highlands in moist ground.
	var.	
/	Hyssopifolia	Mr. Alchorne.
	Agrimonia Eupatoria	Lieth water, Dalkieth Do &c. &c. Bute Arran and Mull.
o	Reseda lutea ?	
	luteola	at Sclate-foord, plentifully on the wall of the Dean garden.
	Euphorbia peplis	
	Peplus	in hortis & inter segetes & ad vias at Abbyhill.
	exigua	on the hill road twixt Craigie hall & Hopeton House inter segetes.
/	segitalis	Mr Bryant.
	Helioscopia	inter segetes passim.
/	Portlandica	Dr Poultney, confer specimen est Paralias.
/	Paralias	
/	platyphyllos	Mr Bryant.
☞ ||	Esula	1768 Mr Benj. Charlesworth plentifully on a bank South of Ld Abercorn's.
	amygdaloid	Mr Bryant.
o	Sempervivum tectorum	in tectis (not in the North).

Icosandria.

o	Prunus insititia var. B	Mr Burges.
	spinosa	in dumetis passim.
	Padus	a frequent plant in the woods in the North & in Auchindinny.
o *	Cerasus	on the water of Nairn J. R. 1767.
*	Avium	Musselburgh water plentifully, anglice Geen Ja: Robertson.
	Crataegus Aria	Salisbury craigs A. F., Lamblash island, and on the Rocks at Loch broom.
	Oxyacantha	on the rocks in Caithness, Sky, Arran.

Sorbus aucuparia	at the Grey mares tail near Moffat, in silvis et montibus frequens.
Pyrus Malus	Port Laing Northferry, Loch Broom.
/ Mespilus	
Spiraea Filipendula	in the Kings park.
Ulmaria	in pratis et ad ripas fluviorum a general plant.
Rosa eglanteria ?	A. F. cat., in the links east of Barnbougle & Corstorphin Castle.
villosa	
canina	in dumetis a general plant.
Rubus idaeus	in dumetis a general plant.
caesius	Musselburgh water.
fruticosus	in dumetis et silvis a general plant.
saxatilis	a general plant among stones, another species or variety by Dr Spense at Dunkeld & by A. F. in a grove near Craigens at Inveraray 1766—a variety.
Chamaemorus	on evry High hill in mossy ground.
/ arcticus	from Mr. Gordon.
Fragaria vesca	in silvis et dumetis passim a general plant.
sterilis	Kings Park & frequent in this neighbourhood—Arran.
Potentilla Argentea	Den of Bethaick.
Argentina	ad vias passim.
o verna	Kings park on Salisbury[craigs]—an Opaca 1772 Mr. L.
reptans	near the New well and in pascuis twixt Saltcots & Luffness.
/ alba	Mr Bryant.
Tormentilla erecta	the most general plant we have in pascuis ericetis in high & low in wet & dry ground.
reptans	plentifully at Trochrig J. R. and twixt Dunkeld & Perth & at Whitehall A. F.
Geum urbanum	a general plant in silvis et ad muros circa Edinam.
rivale	ad ripas fluviorum passim.
F.I.R. Dryas octopetala	plentifully twixt Far & Loch Loyal water, Ben grihum & in Sky at Strath on Lymestone.
Comarum palustre	in marshes ubique a general plant.

Polyandria.

/ Actaea spicata
‖ Chelidonium majus — at Revelston in Aberdeenshire Dr D. Skene.
glaucum — from Barnbougle castle to Boness, in Bute & Arran.
Papaver Argemone — inter segetes circa Edinam, Arran Bute & Mull.
Rhoeas — inter segetes circa Edinam.
dubium — inter segetes circa Edinam Mull and Sky.
* o somniferum
* Tilia
/ Cistus guttatus — Mr Lightfoot 1771.
Helianthemum — Kings park & in montosis sicciori-bus.
/ polifolius — Mr Hudson also Mr Lightfoot.
/ hirsutus,C.marifol[ius] Linn. — Mr Lightfoot.
o Nymphaea lutea — Lochend, in Bute.
alba — Lochend, in evry Loch a general plant.
o / Delphinium
Aquilegia vulgaris — in Collinton wood Carrubber den.
/ Stratiotes
Anemone nemorosa — ubique in silvis a general plant.
/ apennina — Mr Kyle.
/ Adonis
Ranunculus Lingua — Duddingston Loch.
Flammula — in pratis humidis passim a general plant.
repens — in pascuis a general plant.
☞ reptans — at Loch Leven on the side of the Loch.
bulbosus — in pascuis siccis frequens circa Edinam.
acris — in pratis et pascuis a pretty general plant.
auricomus — in silvis viz Auchindinny.
sceleratus — Nor Loch after the water was let out the whole Loch coverd with it.
/ parviflorus
/ arvensis — Mr Bryant.
hederaceus — in rivulis lente fluentibus a general plant.
aquatilis — in omni aqua stagnante a frequent & general plant.
o Ficaria — in pascuis a general plant.

/ Trollius europaeus — Auchindinny & Collinton wood, at Whitburn & in the North a freqt plant.

Caltha palustris — in stagnis et pratis udis passim a general plant.

Helleborus viridis — at Dunglass Den.

Thalictrum flavum Lin. magnum Dod — at North-ferry on Carlin Nose.

minus — twixt Newhaven & Royston & a general plant in sandy ground in the North.

alpinum — on evry very high hill, Ben Buy &c.

another in Arran wh being sent to London was retd as the flavum.

/ Clematis vitalba — Mr Bryant.

Didynamia.

Teucrium scorodonia — Kings park in silvis et ad rupes frequens a general plant.

Ajuga reptans — in sylvis et dumetis frequens a general plant.

F.I.R. pyramidalis — at Ben Nevis F^t William, plentifully in the burn of Killgower & Ord of Caithness.

o Nepeta cataria — on the high road at North Ferry and along the seaside west of said Ferry.

Betonica officinalis — at . . . . inter segetes on the land road to Hopetoun House from Craigiehall & at Port Rie in Sky.

Mentha gentilis Lin. hortensis IV Fuchs. icon. 291.

verticillata —— R. Syn. 232, 4 var. — found by Tillem Bobart.

arvensis — inter segetes in solo humido maero. Bute Arran & Sky.

aquatica s. sisimbrium J B 111.2.223.

hirsuta Hudson — in rivulis et aquosis a general plant.

Nota.

sisymbrium dicta hirsuta glomerulis ac. foliis minoribus ac rotundioribus, R. syn. 233.

/ Mentha	pulegium	Mr Bryant.
	an M. spicata glabra latiore folio Ray Syn. 234 § 3 an Cardiaca Gerardem. 680 ?	
	an Mentha sativa Lin ?	
	an Menth[a] 3. R. Syn. p. 232 an M. 4. ejusdem.	
Glechoma hederacea		umbrosis et ad muros a general plant.
Lamium album		ad vias et in ruderatis et in cultis a general plant.
	rubrum	Inter segetes et ad vias plentifully around Edinb. Bute & Arran.
	amplexicaule	twixt Jocks lodge and sea side on the high road and in Sky.
Galeopsis Ladanum		on the high road immediately above the south bridge at Dalkeith on the road to Foord.
	Tetrachit	inter segetes ubique a general plant.
/	eboracensis	from Mr Lightfoot.
‖	Galeobdolon	by J. Williamson 1768 at Bunston near the house on road side E. Lothian.
/ Stachys germanica		
	sylvatica	in silvis dumetis & ruderatis & at St Bernards well.
	palustris	inter segetes in solo humido & in pascuis humidis.
	arvensis	in hortis inter segetes, on Calton hil! along east wall of Church yard & in Sky ; est Glechoma arvens[is] Huds.
Ballota nigra		Lieth walk, Castle bank to the west.
Marrubium vulgare		on the road to Musselburg and along the Coast to North Berwick.
Leonurus Cardiaca		at Musselburgh.
Clinopodium vulgare		on Salisbury craigs and Cramond water.
Origanum vulgare		at Alva plentifully on east walk also plentifully along Cramond water below ye bridge.
	onites	from Dr Skene confer specimen.

	Thymus serpyllum	in montosis & ad rupes a very General plant.
	——— citriodore	
	Acinos	Mr Br^{t}.
/	Melissa Calamintha	Mr Br^{t}.
/	Nepeta	
/	Melittis melissophyllum	
/	Prunella vulgaris	in pascuis & ad vias a general plant.
	Scutellaria galericulata	plentifully along the west & Northwest coast of Scotland & at Lochcot: Loch.
./	minor	
/	Orobanche major	Mr Bryant.
o	Lathraea squamaria	on Roslin water below Mavis bank.
	Bartsia viscosa	in a sandy soil by the road side near Arncaple by Loch Gyle 1766 A. F..
	Rhinanthus Cristagalli	in pascuis a general plant.
	Euphrasia officinalis	in pascuis & ericetis in high or low ground wet or dry a most general plant.
	Odontites	in pascuis udis a pretty general plant.
/	Melampyrum cristatum	Mr Lightfoot.
/	arvense	Mr Bryant.
	pratense Linn	in sylvis & ericetis e.g. Auchindinnie wood (Hudson differs from Lin. & Haller).
	sylvaticum	from the wood of Strath Spey.
	Pedicularis sylvatica	in ericetis e.g. south side of Pentland hills.
	palustris	in ericetis aquosis in pascuis humidis.
/	Antirrhinum Cymbalaria	
/	Elatine	Dr Pultney.
/	spurium	Mr Lightfoot.
/	repens	Mr Bryant.
	Linaria	inter segetes circa Edinam.
*	minus	Dr Pultney in almost evry garden & potato field Jo: Williamson.
*	majus	on the Castle hill of Stirling on the Old Walls of a garden at Aberlady.
/	Orontium	Mr Bryant.
	Scrophularia nodosa	ad rivulos & in sylvis, general pl. (another species or variety at Hope House at the foot of the Bank north of the house.

	Scrophularia a variety wth fol. ternis	in Auchindinny wood A. F. vid. Haller. 141.
*	vernalis	among trees outside of the Garden of Kinrose.
	Digitalis purpurea	in pascuis aridis & sabulosis a general plant.
/	Sibthorpia europaea	
	Limosella aquatica	in stagno at Fisherrow (Not. this water is now destroyed).

Tetradynamia.

*	Myagrum sativum	plentifully inter segetes at Dornock J R 1767 & inter Linum A. F.
	Subularia aquatica	in a salt marsh south east of New Kelso Loch Carron 68.
/	Vella annua	1771 Mr Ayton.
	Draba verna	in siccis pascuis on the top of walls covered wth turf. ubique Arran and Bute.
/	muralis	Mr Bryant.
F.I.R.	incana	plentifully at Cromarty No. west coast of Sutherland, the one in the Garden wh I made the same, on a hill at Inveraray.
/	Lepidium petræum	from Mr Hudson 1769.
/	ruderale	Mr Bryant.
o *	sativum	ruderatis locis circa Edinam.
	latifolium	A. F. Cat. near St Andrews.
	Thlaspi campestre	on Musselburgh water.
	arvense	inter segetes at Dalry, at Cromarty and at Fortrose by Inverness.
	campestre. var.	
/	perfoliatum	
	bursa-pastoris	ad muros & vias ubique.
	Cochlearia officinalis	in littoribus maritimis a general plant (in alpium scaturiginibus ?) east end Queensferry.
	v[ar]. b. Hudson	an in alpium scaturiginibus ?
/	groenlandica	Dr Pultney a bad specimen.
‖	anglica	Mr Alchorne, at Inverness J : R : 1767.
	danica	Mr Fabricius, Jas. R Orkney.
	coronopus	ad vias & in littore maris from Musselburg to Hop[t] House.
o ‖	armoracia	on the South west side of Arran.

	Iberis nudicaulis	on the road from N. Posso Jo: Williamson, Aberdeen Shire Dr Skene, fields of it twixt Hamilton & Glasgow, & twixt Eglinton & Air.
/ *	amara	in ruderatis.
	Alyssum incanum	Dr Pultney.
/	Dentaria bulbifera	Mr Lightfoot.
/ *	Lunaria rediviva	in ruderatis inter rejectamenta hortorum.
/	Cheiranthus erysimoides	Mr Smith.
	Cheiri	in muris antiquis on the Calton hill rocks, Rothesay Bute.
☞	sinuatus	No tricuspidatus has ever been found in Britain Mr Lightfoot 1773.
	Erysimum officinale	ad vias a general plant.
‖	cheiranthoides	by Ja: Robertson in Arran 1768 north side of the village Sannecks at the seaside.
	Barbarea	in rivulis, New well Bute.
	Alliaria	Salisbury, near Kirk Michael Mr Burgess.
	Hesperis matronalis	on a rivulet near Glencorse A. F.
	Raphanus Raphanistrum	inter segetes a general plant.
*	sativus	in ruderatis.
*	Brassica orientalis	Castle Bank A F vid. specimen.
*	Rapa	cum priore A F.
‖	campestris	J. R. 1767 inter segetes at Larg, in Bute and Arran 1768.
*	Napus	Stirling Castle hill, Leith Links.
	muralis	Mr Smith Ramparts of Berwick J. R. 83.
/	Turritis glabra	Mr Bryant.
	hirsuta ?	confer specimen, at Pennycuick village on a bank east of the town plentifully, Salisbury craigs, on the sea coast near Aberdeen.
	Arabis thaliana	Kings park, water of Lieth, near Kirkmichael Mr Burgess.
/	Turritis	Mr Smith 81.
	Cardamine pratensis	ubique in pratis humidis a general plant not on high grounds.
	var. b. of Hudson.	
	amara	at St Bernards well and sent by Mr Burgess from Kirkmichael & in other places J. R.
	Impatiens	ignoratur unde.

Cardamine	parviflora	at St Bernards well A. F.
	Impatiens altera hirsutior, Ray syn. p. 300. X4	in Hamilton wood. J. R.
	hirsuta Linn	in the kings park.
	petraea	J. Robertson 1768 in Mull on the top of Ben Varnoch & at Pot a Stor in Sky.
Sisymbrium	Nasturtium	in rivulis a general plant.
/	sylvestre	Mr Alchorne.
	amphibium ?	Restalrig on the road to the Sea near the water tumble & in fife.
	moniense	from Mr Bryant but it does not appear to be it.
‖	monense	1766 by James Rob. near Air on the Coast.
	Irio	near the New well.
	Sophia	ad vias circa Edinam on the Castle bank.
Sinapis	nigra	inter segetes.
	alba	inter segetes.
	arvensis	inter segetes a general plant.
Crambe	maritima	Lumsden shore St Abbs head A. F. in Arran on the South-west side plentifully.
* ? Isatis	tinctoria	
Bunias	Cakile	on sandy shores on this side of the Island and on the Carrick shore.

Monadelphia.

Geranium	cicutarium ?	on Brede's hill AF.
	moschatum ?	on Lieth walk.
/	maritimum	
/	nodosum	Mr Bryant.
/	phaeum	Mr Bryant.
	sylvaticum	in sylvis (Auchindinny wood) Mull & Sky.
	pratense	on the banks of Rivulets a general plant.
	Robertianum	in saxosis (kings Park) a General plant.
	lucidum	C[um] priore.
/	rotundifolium	Dr Watson (forte error.).
	perenne	Mr Bryant Edinburgense A.F. Catalog :
	molle	ad vias a pretty general plant.

Geranium dissectum Linn.	Stockbridge well above Cannon Mills, Arran.
columbinum ?	
pusillum ?	
sanguineum	on Salisbury [Craigs] kings park, Mull.
Althoea officinalis	south end of Arran J. R. 1766.
Lavatera arborea	the Bass.
Malva sylvestris	ad vias circa Edinam copiose.
rotundifolia	cum priore.
moschata	at Abernethy A.F. Bethaick J : R :, Hamilton wood at Corston bridge, & in Perth shire at Aiken head near. . . . .

Diadelphia.

Fumaria officinalis	inter segetes a general plant.
capreolata	inter segetes.
o bulbosa	near Glasgow Dr Robert Simpson introduced by the Monks.
claviculata	in saxosis in the North on the walls and tops of ye houses.
Polygala vulgaris	in pascuis a general plant.
Spartium scoparium	in dry sandy soils pretty frequent in the Low countries.
Genista tinctoria	at Rammerskails and on the road from Moffat to Lochmabbin.
Genista anglica	in ericetis siccis.
Ulex europaeus	in pascuis siccis arenosis vel saxosis not a general plant but they are cultivating it in many the distant parts.
/ ——————— var.	
Ononis spinosa	in solo sicco arenoso west of Royston.
arvensis	in pascuis & inter segetes a general plant.
/ repens	Dr Pultney.
/ Anthyllis Vulneraria	in pascuis siccis (Salisbury) a general plant.
/ Pisum marinum	1771 Mr Ayton.
/ * arvense	
Orobus tuberosus	in pratis pascuis nemoribus frequens a general plant not on high grounds.
sylvaticus	on an old camp wall at Langfaugh on a bank below the bridge at the bield on the road to Moffat & Sky.

/	Lathyrus	hirsutus	Mr Aiton.
/		Aphaca	Mr Bryant.
☞	F.I.R.	heterophyllus	Mr Oaks 1769 near Inverness.
		latifolius	south west end of Arran in dumeto (betulino) at Red head or twixt it & Arbroath e Saxis.
/		sylvestris	Mr Alchorne.
/		palustris	Mr Bryant.
		pratensis	in pascuis frequens a general plant.
		tuberos[us]	unde ignoratur.
	Vicia	Cracca	in sepibus & inter segetes a pretty general plant.
		sylvatica	on Salisbury craigs, at Farr Arran Bute, in sylvis AF.
		sepium	on Salisbury [craigs] in sylvis AF. at Far Arran & Bute in sandy ground.
*		sativa	inter segetes.
		——— var.	
/		lutea	Mr Aiton 1771.
		lathyroides	at Craig Lieth Quarry Salisbury [Craigs] Bute & Arran.
*		Faba	
	Ervum	soloniense ?	vid Vicia lathyroid[es].
		hirsutum	inter segetes a general plant.
/		tetraspermum	
	Ornithopus	perpusillus	at Falkland, plentifully twixt Hamilton & Glasgow & Irwin and Air J. R.
/	Hippocrepis	comosa	
/	Hedysarum		
	Astragalus	Glycyphyllos	in a gravelly soil neat Laswade on the high road & in Airly wood & plentifully twixt Cromarty & Fortrose.
		arenarius	Lieth links kings park (Icolumb kill) Calton hill.
☞	F.I.R.	uralensis	at Cromarty at Farr at Glen Criven on a hill, vid. letter to Commiss. of annexed Estates.
	Trifolium M.	officinalis	at Lufness mill.
		ornithopoides	at Maitland bridge on the road to Musselburgh.
		repens (& var: hybridum	in pascuis frequens a general plant (var. in arvis).
		ochroleucum	Mr Bryant.
		pratense	in pascuis siccis ubique a general plant.

	Trifolium medium	twixt Collington and Swanston near the latter in a ditch, Sky copiose.
/	maritimum	Mr Alchorne.
	arvense.	Kings park, Arran Mull and Sky.
	striatum	Lieth walk.
/	glomeratum	
/	scabrum	
/	subterraneum	
/	fragiferum	Mr Bryant.
	agrarium	in pascuis circa Edin. Bute.
	procumbens	c[um] priore in pascuis frequens a general plant.
	filiforme	1771 from Perth J. R.
/ *	Medicago falcata	
	sativa	
	lupulina	in pascuis frequens a general plant Bute & Arran.
	poly: var. arabica	found some years by Ja: R. on Lieth plentifully in a clump.
	Lotus corniculatus	in pascuis siccis ubique var (vel species alia) in humidis a general plant.
	var.	
	Hypericum perforatum	on dry banks along water-sides plentifully around Edinb.
	humifusum	at the Nor east end of Pentland hills, twixt Hamilton & Glasgow, at Micklour perthshire, at Falkirk.
	pulchrum	in Saxosis a general pl. Kings park.
	Androsaemum	in Arran & in the Dens of Colein & in several parts of the west highlands—J. R. did not see it anno 1767. (Mr Lind Ilay 1786).
	montanum	Mr Burgess.
	hirsutum	Auchindinney wood & along Roslin water, St Bernards well.
	quadrangulum	most plentifully in Arran and Bute, twixt Coltbridge & St Bernards well.
	elodes	at Loch ransey nor west end of Arran.

Syngenesia.

Tragopogon pratense	at Sandy haugh near Royston plentifully & along this side the firth, Icolumb kill.

o * Tragopogon porrifolium — at Hamilton on the outside of the garden walls.
/ Picris echioides — Dr Freer from London.
/ hieracioides — Mr Bryant.
Sonchus oleraceus — ad vias inque ruderatis hortis a general plant.
several var.
arvensis — inter segetes a general plant.
Lactuca virosa — Kings park south side of Arthur seat.
saligna — Mr Lightfoot.
/ Prenanthes muralis
Leontodon Taraxacum — in pascuis ad vias (neitheir in Mull nor Sky).
hispidum — in a small island below the Mill at Auchindinny bridge.
autumnale — in pascuis copiose a general plant.
Hieracium alpinum — Ben Croocken at Loch Awe J. R. 1766.
Pilosella — in pascuis copiose a general plant.
paludosum — A. F. cat. in a marsh near Roslin & plentifully in the south of Scotland.
murorum — in muris antiquis in rupibus (salisbury craigs) a general plant.
several var.
sabaudum — Auchindinny wood A. F.
umbellatum — on the seaside west of Barnbougle castle.
/ dubium — Mr Smith 81.
Crepis tectorum — in pascuis siccis & ad vias a general plant.
var.
fœtida — Mr Lightfoot.
/ Hyoseris minima — Dr Pultney, Mr. B. 1766.
Hypocheris radicata — in pascuis a general plant.
‖ glabra Linn.
‖ glabra — conf. specim :
Lapsana communis — ad vias inque ruderatis a general plant.
Cichorium Intybus — on Musselburgh water near Eastpark.
Arctium Lappa — ad vias a general plant.
Serratula tinctoria — Dr Freer from London 1767. Mr Huggan 1769.
alpina — in alpibus scoticis saxosis—(Ben Croochen).
arvensis — inter segetes a general plant and frequent.
var.

	Carduus lanceolatus	ad vias a general plant.
	nutans	Musselburgh Links.
	acanthoides	head of Lieth walk near the dunghills.
	crispus	in ruderatis & ad vias circa Edinam.
	palustris	in humidis a general plant.
o	helenioides	twixt Byreney and Bevely hill, on the road to Moffat betwixt 38 & 39 mile stone ¼ mile this side of tweed brae foot.
	Marianus	in ruderatis circa Edinam kings park (Castle Bank).
/	heterophyllus	Dr Pultney w^h is the Plant Mr Hudson means by ye dissectus.
/	acaulis	
	Carduus Onopordon Acanthium	at Cockeny East Lothian on the road side.
	Carlina vulgaris	twixt John's haven and Bervie & in many other places of that coast.
	Bidens tripartita	Nor Loch a general plant in aquosis Stagnantibus.
	cernua	in aquis stagnantibus circa Edinam.
	minima	Mr Lightfoot.
	Eupatorium cannabinum	a frequent plant in the North on wet rocks by the Seaside.
	Tanacetum vulgare	all along the water of Lieth down from Collinton & from Smiton to Inveresk on the road side & in general ad pagos.
/	Artemesia campestris	
	maritima	at old Slains Castle on the Seaside plentifully & at Tinningham &c.
	Absinthium	at the Society on the Seaside near Hopton House & on the opposite coast near Bruntisisland.
	vulgaris	
	Gnaphalium dioicum	on Arthur seat and on many other dry hills a general plant.
	quaedam species novae	on many high hills of the North.
	Do.	on Ben Nevis—an G. alpinum pulchrum J. Bauh. p. 161 vol III?
	sylvaticum	in pascuis humidis.

	Gnaphalium uliginosum	inter segetes solo humido & locis hyemi inundatis aestate siccatis.
/	gallicum	81 Mr Smith.
/	Conyza squarrosa	Dr Pultney.
	Tussilago Farfara	inter segetes & ad ripas fluviorum a general plant.
o	hybrida	below Colinton bridge A. F. cat.
o	Petasites	ad ripas fluviorum a general plant.
/	Erigeron acre	Mr Bryant.
/	canadense	
	alpinum	Mr Stuart fm high rocks East side of Ben Lawers 87.
	Senecio vulgaris	in ruderatis, hortis & ad vias.
	sylvaticus	Arthur seat on the South side & plurimis aliis locis.
	viscosus	Castle bank Salisbury craigs Bute Arran Sky.
	Jacobæa	in pascuis cultis.
	aquaticus	in paludibus at Myreside a pretty general plant.
o	sarracenicus	Dr Skene Aberdeen shire.
	Solidago Virgaurea & 3 var.	in sylvis dumetis & in Alpibus saxosis frequens.
/	cambrica	Mr Bryant conf. spec. & notes on the Solidago's.
	Aster tripolium	in salt marshes and on Rocks by the Sea side.
	Inula Helenium	Arran at Killdonnan (South end of Arran.
	dysenterica	Arran west of Killdonan inter segetes.
/	Pulicaria	
	Bellis perennis	in pascuis opimis.
	Chrysanthemum segetum	inter segetes of all plants the last in flower
	Leucanthemum var.	except in pascuis cultis siccis.
o	Martricaria Parthenium	
	maritima (Anthemis maritima)	plentifully on the Shore twixt the Coves & . . . . . Carrick Coast.
	Chamomilla	
	Anthemis nobilis	
	arvensis	
	Cotula	
	tinctoria	
/	Achillea Millefolium	in pascuis siccis frequent a general plant.

	Achillea Ptarmica	inter segetes vel potius ad margines segetum in solo humido.
	Centaurea Cyanus	inter segetes circa Edinam (not in the North).
	Scabiosa	at Luffness mill at Bethaick plentifully at Farr.
	Jacea nigra Gerard	on the baulks of corn riggs a general plant.
/	Calcitrapa	
/	Othonna palustris (nunc Cineraria)	
/	integrifolia (nunc Cineraria)	Mr Bryant
o /	Filago maritima (nunc Athanasia mar[itima]	
	germanica	in pascuis siccis (south of Arthur seat, Bute and Arran).
	montana	along the sea side.
/	gallica	Mr Lightfoot.
	Jasione montana	on the road from Mofat to Lochmaben, in the North plentifully, twixt Hamilton & Glasgow. & near Glasgow on Edr. road.
	Lobelia Dortmanna	in the Lochs of the North & West.
o	Viola odorata	to the east of Lochend.
	hirta	twixt Johns haven & Bervie J. R. on Hartfel.
	palustris	in a bog on Pentland hills & frequent in the North.
	canina	Kings park in siccis sterilibus frequens & generalis planta.
	alpina	1771 Mr Ayton not yet found in England.
	tricolor	inter segetes & in pascuis sterilibus.
	lutea	at Brede on ye road opposite to Lowdon hill a variety of tricolor vid Ja: Robns. letter 30 May 1768.
/	Impatiens noli me tangere	

Gynandria.

For the Orchis confer spec. & notes wh are too long to be inserted here.

F.I.R.	L	Orchis bifolia	in pascuis humidis & sylvis a general plant.
	2	mascula	in pascuis A. F.

o	3	Orchis Morio	A. F. cat. .confer No 6.
	4	pyramidalis	on the Auth of Ja. Ro. in arenosis A F cat. my specimen from Engd.
/		ustulata	Dr Pultney.
‖	6	(coriophora	1768 J: Rob. twixt Loch Drummore & Land house (not the Coriophora confer specimen).
/		purpurea	Mr Lightfoot.
/		militaris	Mr Lightfoot.
		latifolia	in humidis a general plant.
o		maculata	in pascuis a general plant and frequent.
		conopsea	in pascuis general but not frequent except at Far.
/		Satyrium hircinum.	Mr Lightfoot.
		viride	at the Crooks, betwixt N. ferry & Innerkeithing & frequent in y^e^ North.
☞ F.I.R.		repens	in a wood opposite Moy hall south side of y^e^ road to Inverness.
F.I.R.		albidum	near Balincrieff in west Lothian & in the north eg at Strathpiffer.
/		Ophrys nidus avis	Dr Pultney.
/		spiralis	from Mr Bryant.
F.I.R.		ovata	twixt Tongue & Skerry by the Sea side, in Bute.
F.I.R.		cordata	near Inverness in Eglinton wood copiose 1768.
/		paludosa	Mr Bryant 74.
/		Monorchis	
/		apifera	Mr Bryant.
/		muscifera	
/		Cypripedium	
/		Serapias latifolia (Hudson) Helleborine Linn. longifolia Hudson Lin. S. P. ed. 12.	Myreside the small plant, at Hamilton the larger plant.
/		Arum	
		Zostera marina	Black rocks a freqt & general plant in great qty at Loch Ryan in clay sleech in the Sea.

Monoecia.

	Zannichellia palustris	in Duddingston Loch A. F. cat.
	Lemna trisulca	in Lochend & Duddingston Loch.
	minor	in stagnis.
/	polyrhiza	Mr Alchorne.

	Typha latifolia	Lochend Lochrin at Sr Wm Mercer of McLour Bute & Sky.
/	angustifolia	
	Sparganum erectum	In stagnis a general plant.
	natans	Bevely Moss in Bute & Sky, in rivulis leniter fluentibus, rarius.
	Carex dioica	East of Newmills near Loudoun & twixt Air & Irwine.
	turfosa	from Loudoun to Air 1768 Ja Robn.
	nova species	J. R. at the mouth of the water of Naver.
	pulicaris	Bute Arran & in dry moors.
	paniculata	J. R. 1767.
/	disticha	Mr Bryant another plant collected in England under the same name from Mr Kyle 1771.
	leporina	in Bute at Mount Stewart.
	arenaria	Lieth Links.
/	brizoides	
	vulpina	twixt Air & Irwin.
‖	spicata	in a moss half a mile to the South of Maybole, confer a diff[t] plant under the same name from Mr Kyle 1771 w[h] was collected in England.
	muricata	Bute Mull & Sky 1768.
☞ ‖	loliacea	Mr Fabricius 1767.
/	canescens	
	remota	Bute Arran Mull.
	flava	twixt Air & Achincrue in wet ground & in several other places.
	tomentosa	J. R. 1768 in ye Links of Air.
/	pilulifera	
	saxatilis	
‖	panicea	near Castle Kennedy a mile nor west in a marsh.
	——— ?	plentifull in a marsh on the North west side Castle Kennedy.
	caespitosa	an English plant under this name from Mr Kyle 1771.
☞ ‖	limosa	Mr Fab[ricius] 1767.
	pallescens	
	distans	
/	Pseudocyperus	
‖	pendula	on Musselburgh water opposite to Smiton.
	sylvatica	used in Lapland for flax but not for spinning.

Carex acuta — in locis humidis.
several var.
vesicaria — grows in a marsh near Maybole & in Strathpeffer.
hirta — near Kilmarnock, Bute & Arran.
/ digitata — Mr Smith 81.
a non descript
a non descript
F.I.R. Naesmithia articulata — est Eriocaulon decemangulare Ja. Robertson 1768. Skye in two small Lochs half a mile west of Sligachan on the road side to Brackadale.

Betula alnus — ad rivulos in pascuis humidis.
alba — a frequent & general tree in the highlands on the sides of hills & bottoms along rivulets.
☞ nana. — Sir James Naesmyth in the moors north of Loch Glash Rossshire.

/ Buxus
/ Urtica pilulifera
urens — on dunghills & in ruderatis.
dioica — ad muros et ruderatis.
/ Xanthium
/ Amaranthus
Ceratophyllum demersum — in Duddingston Loch.
Myriophyllum spicatum — in lacubus et rivulis leniter fluentibus a general & frequent plant.

/ Sagittaria sagittaefolium
/ Poterium sanguisorba
o Quercus Robur — in Argyleshire chiefly.
* Fagus sylvatica
/ Carpinus Betulus — from Mr Bryant.
Corylus Avellana — cum Betula alba.
Pinus silv[estris] foliis brevibus glaucis conis parv. albentibus Ray Histor. — a large wood near Loch Carron & at Strathmore in Ross. & twixt Corry briech & Dalwhinney on the road from Inverness. 1769 Mr Pennant measured fir trees 12 feet round in Innercalls woods vid. Pennants Hebrid. p. 343.

Dioecia.

Salix myrsinites — Mr John Stewart.
Lapponum — Mr John Stewart.

	Salix pentandria	south side of Pentland hills, near Whitburn on the road-side, near Moffat on the road side twixt & Ericstone brae.
	fragilis	A. F.
	purpurea	1768 Ja: Rob: Cramond water, below the bridge twixt Air and Auchincrue.
/	amygdalin	
	herbacea	
	arenaria	in dry moors all over the North.
	repens	in arenosis J. R. twixt Forres & Nairn.
	fusca?	in paludosis.
	caprea	in arenosis.
/	rosmarinifol[ia]	Mr L. 1772.
*	alba	

We have certainly more Salix, ? several new ones.

	Empetrum nigrum	in ericetis ubique a general plant.
o /	Viscum album	
/	Hippophaë rhamnoides	
	Myrica Gale	in Ericetis paludosis (it is not nearer Edinb. yn Aberdour).
*	Humulus Lupulus	
/	Tamus communis	
*	Populus alba	
*	nigra	
	tremula	in sylvis et in rupibus septentrionalibus frequens.
	Rhodiola rosea	in Dunglass den in saxis ad mare et in Alpibus Scoticis septentrionalibus frequens.
	Mercurialis perennis	in saxosis et dumetis frequent & general.
o	annua	in ruderat[is] at Burntisland Mr Lightfoot.
/	Hydrocharis Morsus ranae	
	Juniperus communis	on the sides of high hills in a dry soil a general plant.
	Taxus baccata	on the Dear Island of Loch Lomond A. F. 1766.
/	Ruscus aculeatus	
/	Bryonia alba	

Polygamia

	Holcus lanatus	in pascuis ubique.
	mollis	in pascuis A. F. cat.
/	Ægilops incurva	Dr Pultney 1769.
	Valantia cruciata	in dumetis &.

Parietaria officinalis — ad Muros all over Fife, at Prestonpans, at Balincrieff West Lothian, at Iona at the Monastery, Sky Dunveghan Castle.

/ Atriplex portulacoides
laciniata — in littoribus maris.
/ pedunculata — Mr Smith 81.
hastata — on the Bass A. F.
patula — in ruderatis.
varieties.
‖ littoralis — near Lufness Miln, A. F.
/ pedunculata
* Acer Pseudoplatanus
* campestre
Fraxinus excelsior — in sylvis cum Betula alba et Corylo.

Cryptogamia.

Those crossed × *are separately placed for the class.*

Equisetum sylvaticum
arvense
palustre
var. β
fluviatile
limosum
hyemale
Ophioglossum vulgatum ×
Osmunda Lunaria ×
regalis × — in Arran Ja: Robertson 1766, at Blair D[rummon]d. J. W[illiamso]n. 1768.
spicant
crispa
Acrostichum septentrionale
Thelypteris — now Polypod.
Pteris aquilina
Asplenium scolopendrium ×
Ceterach
Trichomanes ×
viride
marinum ×
Ruta muraria
Adiantum-nigrum ×
Polypodium vulgare
cambricum

Polypodium	filix-fœmina	
	filix-mas	
‖	iobatum H.	
	aculeatum	
	Dryopteris	
	Phegopteris	
	fragile	at Alva in the dens A. F., in Assynt J. R. 1767.
‖	Lonchitis	
‖	Rhæticum	1780.
	cristatum	1780, in Arran 68 J. R. plentifully on the south side of the Village of Sannecs.
	thelypteris	

1780 I carefully revised the Polypodia and fixed the above.

Adiantum	
Trichomanes pyxidiferum	from Dr Pultney.
tunbridgense	on Ben Buy 1767 Mr Oaks.
Pilularia globulifera	to the South of Mutton Hole; in the Ditches at Air, at Kennoway in Fife.
‖ Isoetes.	1776 by A. Menzies in the west end of Loch Tay.
Lycopodium clavatum	
inundatum	
annotinum	
alpinum	
selago	
selaginoides	
Sphagnum palustre	
var. *b*?	
Phascum acaulon?	
Fontinalis antipyretica	
minor	
Splachnum ampullaceum	
Polytrichum commune Lin	
alpinum Lin	
striatum Hudson	
Mnium	
Bryum apocarpum var. *b*. Linnæi	
apocarpumLinnæi pomiforme.	
fontanum Hudson	the plant he means by this name I have under Hypn. Dill. tab. 44 fig. 2d.
pyriforme	

Bryum extinctorium		
	subulatum	
	rurale	
	murale.	
	scoparium	confer Dill. desc.
	glaucum ?	1768 Ja: Rob.
	truncatulum	
	viridulum	
☞	squarrosum Lin.	confer spec. B. scoparii.
	argenteum	
	pulvinatum	
	capillare	
	annotinum	
	hornum	
	Hygrometricum	
Hypnum bryoides		Dillenius tab. 38 fig. 31.
	taxifolium	
	complanatum	
	lucens	in a rivulet near Roslyn.
	triquetrum	
	serpens	
	sciuroides	confer specimen Dillenii tab. 44 fig. 2d.
Jungermannia undulata		
	complanata	
	dilatata	
	epiphylla	on a stone in Auchindinny wood west of the bridge 1768 Aprile wth the former.
	multifida	
	furcata Vel Dill. t. 74 f 47.	
Targionia.		
Marchantia polymorpha		
	var.	
	hemisphærica	
	conica	on a stone in Auchindinny wood west of the Bridge 1768. Ap[ril].
‖ Blasia pusilla.		Ja: Robertson 1768 in Hamilton wood on a stone.
Riccia		
Anthoceros		
Lichen		
Tremella Nostoc		In Pilton wood.
Chara vulgaris		
	hispida	
	flexilis	
	tomentosa	
/ Fucus ovalis		

NOTES

FROM THE

ROYAL BOTANIC GARDEN,

EDINBURGH.

APRIL 1908.

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GLASGOW:

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Fucus palmatus
coccineus
ραικωδες
barbatus Mr Lightfoot 73.
crispus
semiconicus
semicircularis
congestus N.
excisus
canaliculatus
echinaceus
cervinus
vittatus
rubens
sanguineus
alatus
cartilagineus
plumosus
cupressus
corallinus
pygmaeus
dentatus
pinnatifid[us]
var coriaceus.
fimbriatus
conglomeratus
viscidus
saccharinus
var.
phyllitis
esculentus
digitatus
ογλος
serratus
vesiculosus
var.
inflatus
spiralis
nudus
pallidevirens
filum
funicularis
lampetra
loreus
fascicularis
lumbriculis
fastigiatus
albus ?
tumidus
coriaceus

Fucus	rigidus	
	aculeatus	
	an purpur[ens] Huds.	
	torulosus	
	granulatus	
	confertus	
	var.	
	nodosus	
	var.	
	ensiformis	
	siliquosus	
Ulva		
Conferva	rivularis	
Byssus		
Agaricus		
Boletus		
Hydnum		
Phallus	esculentus	in the neighbourhood of Westerhall Sr Ja : Nasmyth, Dr Langlands near Hawick
	impudicus	in the garden of the Minister of Dalmenie 1772, in the Botk Garden 84.
Elvela		
Peziza	lentifera	
	acetabulum	
☞	cupularis	1768 hot-bed of horse-dung J. W.
Clavaria		
Lycoperdon	Tuber	at Megerney in a fir wood A. F.
☞ ‖	Carpobolus	1768 hot-bed of Bark J. W.
Lycoperdon		
Mucor	septicus	Bark bed.

The Occurrence of a Cavity filled with Hairs in the Stem of a Species of Cucurbit.

BY

J. W. BEWS, M.A., B.Sc.

With Plate XXV.

The way in which the Hair-Cavity arises.

The stem of this species of Cucurbit, like most of those which I have examined, is a hollow one. The nodes are solid, but the central cavity of the stem extends the whole length of the internode. The cells surrounding this ordinary central cavity differ in no way from the other parenchymatous cells of the stem. They are fairly large thin-walled cells, and are not arranged in any definite manner around the central hollow.

The vascular bundles are of the bicollateral type, with large vasa in the centre, phloem on the outside and also on the inside.

The stem is pentagonal in outline, with five prominent ridges.

The whole surface of the plant is covered with hairs (Fig. 4).

In one part of the stem certain cells form a projection into the central cavity. These projecting cells are at once marked off from the other surrounding cells in being smaller and full of cell-content. The projection appears to have originated as a single cell, and afterwards, in the centre of the projection, there is meristematic tissue.

As this structure is followed along the stem, it increases in size till it gradually fills up the whole of the central cavity.

But before it has altogether done so, in the centre of the projecting portion, that is to say, in the centre of the meristematic tissue, another cavity arises, and this is the cavity which contains the hairs.

[Notes, R.B.G., Edin., No. XIX., April 1908.]

Appearance of the Hair-Cavity (Figs. 1 and 3).

This cavity differs entirely from the original central hollow. It is bounded by a very regular layer of cells, which differ greatly in appearance from the other cells of the pith, being much smaller, and having thicker walls and abundant cell-content. In fact, they are extremely like the ordinary cells of the epidermis.

Two or three rows of cells next to this layer also differ from the cells of the pith in being smaller and having plenty of cell-content. Not only, therefore, does this hair-cavity have a distinct origin apart from the original central cavity, but the cells surrounding the two cavities also differ.

Appearance of the Hairs (Figs. 1, 2, and 3).

From the surrounding layer of cells hairs project outwards into the cavity. These hairs are of two kinds—pluricellulur and glandular.

The former are the more numerous. They are hairs of the kind which De Bary describes as "Conical Multicellulur Hairs"*

The foot-cell differs slightly in appearance from the others. There may be as many as eight or nine cells in a hair, though in most of them there are not quite so many. All the cells are full of protoplasm (Fig. 1).

The glandular hairs are not nearly so numerous. They are similar to those which De Bary calls "Capitate glandular hairs," *i.e.*, the free end is swollen to form a round head, the transverse section of which exceeds that of the stalk.

The stalk is short, 1–3 celled (Fig 2).

In one part of the stem which I examined, in addition to the main hair-cavity, a very much smaller one appeared close to it. This smaller hair-cavity was also filled with hairs of both kinds.

Before discussing the possible significance of this structure, I may here explain that the material which I first examined was among that which had been supplied from the Edinburgh Royal Botanic Garden for the use of students in the Winter Class of Botany. It consisted of short pieces of the stem of several Cucurbits. I was able to find three or four short pieces, probably

* De Bary. Comparative Anatomy of Phanerogams and Ferns, pp. 59–61.

cut from the same plant, which contained this hair-cavity. In one piece I was able to trace its origin as above described. It extended for several inches along the stem, but I was unable to follow it to the end.

It was difficult, too, to say definitely to what species of Cucurbit the little piece of stem belonged. However, I have this year made sections of, and examined carefully, all the species of Cucurbits which are grown in the gardens from which the specimens might have been derived.

These include—*Cucurbita maxima* and var. *turbaniformis*, *C. Pepo* and its varieties *aurantia*, *verrucosa alba*, and *mammeata*, *Lagenaria Sipho*, *L. congourda*, *L. clavata*, *L. pyrotheca*, *L. vulgaris*, *Cucumis Sacleuxii*, and *Benincasa cerifera*.

With the exception of the last named, *Benincasa cerifera*, the stems of all the species differ slightly from that in which I found the hair-cavity, so that now I am sure that it was from *Benincasa* that the pieces which I examined were cut.

The specimens of *Benincasa cerifera* now growing in the houses are not yet full grown.

However, in the young growing plants near the nodes I notice that there are appearances of meristematic tissue similar to that above described. I am unable to say whether the hair-cavity will develop later.

The Nature of the Cavity and Hairs.

De Bary* describes various kinds of Internal Hairs. He divides them into two categories, glandular and non-glandular. The only forms of the first category, he says, are those glandular hairs first noticed by Mettenius, and described later by Schacht, in the air-cavities of the rhizome and base of the petiole of *Aspidium Felix-mas*. These are unicellular capitate hairs, and secrete "a firm greenish brilliant thick layer of resin."

Intercellular hairs of the second category occur in *Pilularia*, *Nymphæaceæ*, *Aroideæ*, *Rhizophora*, and *Limnanthemum*.

In *Pilularia* they are rolled up like watch springs; in *Nymphæaceæ* they are stellate hairs, and in the others they are either stellate or H formed, and according to De Bary they are

* Comparative Anatomy of Phanerogams and Ferns, Sect. 53.

fundamentally related to selerenchymatous fibres in every respect, and are only special cases of the latter, distinguished by their form and distribution.

It is at once obvious that the hairs in this hair-cavity cannot be called "Internal Hairs," according to De Bary's description of such.

I have already said that the whole surface of the plant is covered with hairs. These hairs on the outside of the stem are also of the two kinds, pluricellular and glandular (Fig. 4).

They are absolutely identical in appearance with the hairs that fill the cavity. The pluricellular are again the more numerous, and the proportion of glandular to pluricellular is the same as in the hair-cavity.

The cells surrounding the cavity are exactly like the cells of the epidermis.

These facts point to the conclusion that we have here an internal epidermal structure.

It is not exactly the case, however, that the cells surrounding the central hollow, in response to an air-environment, have started to produce an epidermis with hairs. Such would doubtless be a likely and natural explanation, if it were not for the way in which the hair-cavity arises.

Wounding the surface of a stem has been said to cause an internal epidermis to be produced, but I hardly think that any wound on the surface would cause such a structure as this to arise. And, as far as I could see, there was no wound on the surface of the stem.

Another attempt at an explanation is that this might be an infolding of the epidermis, the infolded loop, as it were, being cut off and forming the cavity. But looking again to the method in which it arises, this explanation seems impossible. No disarrangement of the vascular bundles, nor any other irregularity in the appearance of the stem or distribution of the tissues is apparent, and a vascular bundle lies directly between the point where the hair-cavity begins and the outside of the stem.

The most natural explanation—which, however, is by no means a complete one—is that certain cells in the interior of this plant have taken on themselves the character of meristem and have laid down an epidermis.

This epidermis does not line the central hollow, as would perhaps be expected. Instead of that, the central cavity becomes filled up, and a new cavity is formed which is surrounded by this internal epidermis.

As to the physiological significance of the structure, further investigation will be necessary before anything can be said.

In conclusion, I should like to express my sincerest thanks to Professor Bayley Balfour, under whom these observations were made, and to Mr. W. Edgar Evans, B.Sc., who prepared the microphotographs.

EXPLANATION OF THE FIGURES IN PLATE XXV.

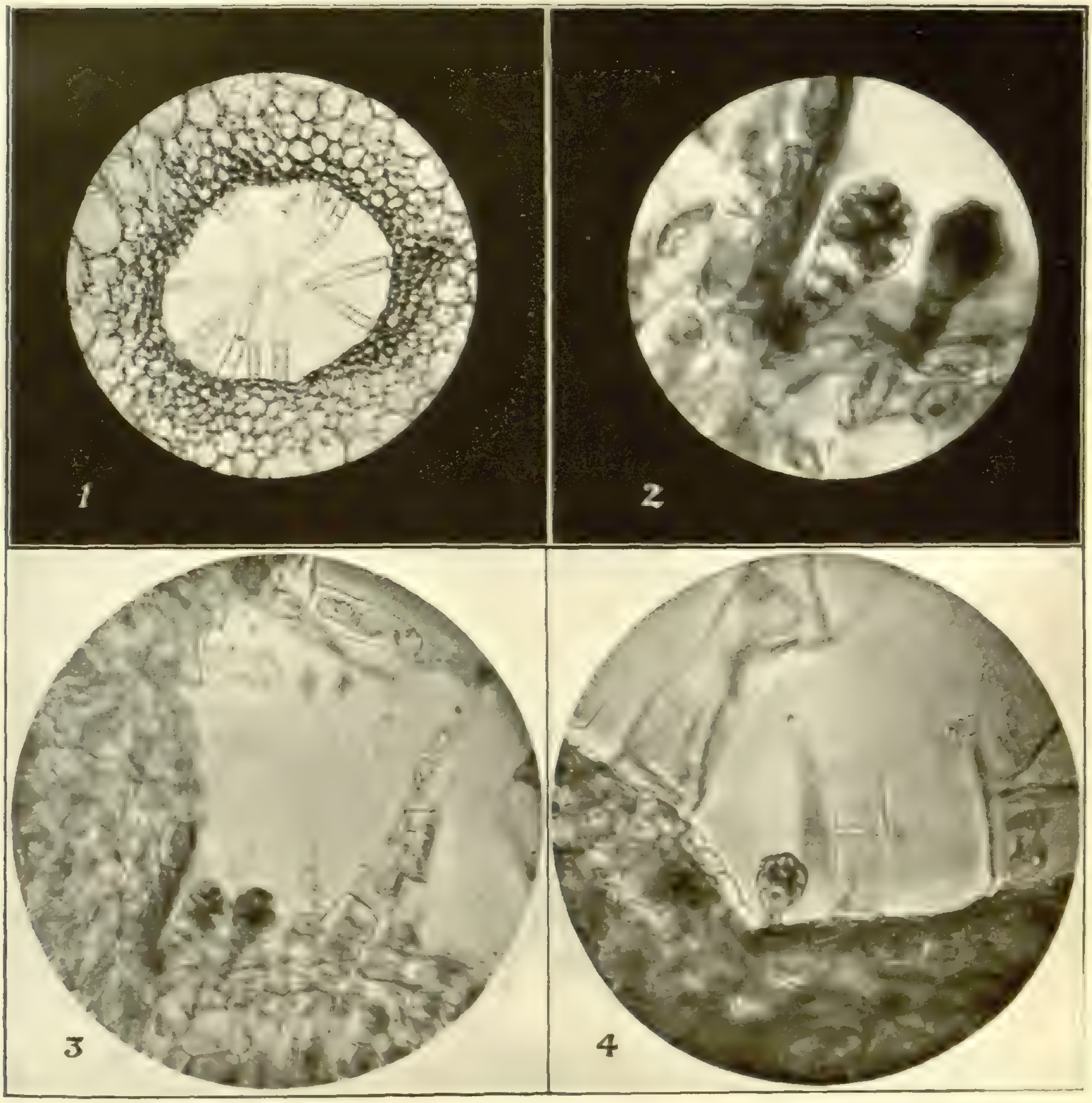
Illustrating Mr. J. W. Bews' paper on "A Cavity Filled with Hairs in the Stem of a Cucurbit."

FIG. 1. The hair-cavity and the pluricellular hairs. General appearance of the cells surrounding the cavity.

FIG. 2. A glandular hair in the hair-cavity with short stalk and round globular head.

FIG. 3. Part of the cavity showing both pluricellular and glandular hairs.

FIG. 4. The ordinary epidermis with pluricellular and glandular hairs similar to those in the cavity.



Beas. – Hair-cavity in Cucurbit.

Vegetable Remains from the Site of the Roman Military Station at Newstead, Melrose.

BY

HARRY F. TAGG, F.L.S.

The following constitutes a report based upon the examination of material submitted from time to time by Mr. James Curle, of Priorwood, Melrose, during the excavation of the site of the Roman Military Station at Newstead, Melrose.

Mr. Curle's investigation of the site,[1] as an antiquarian authority points out, forms "a great contribution to our knowledge of both Roman antiquities and Roman Scotland," and it was hoped that an examination of the vegetable remains from the various pits and trenches excavated, would contribute something to a knowledge of the flora of Roman Britain.

The nature of the material which was sent to the Royal Botanic Garden, Edinburgh, for investigation was of two kinds :—

(1) Samples of the deposits from the various pits and trenches opened during the work of excavation ;

(2) Definite articles of interest such as implement shafts.

The samples of earths from the pits gave numerous twigs of trees, pieces of bark, branches, chips of wood, and seeds, which had found their way into the pits at the time the latter were being filled with refuse from the station. From the pits and trenches, and mixed with the vegetable debris, came many of the important finds of Roman implements and other articles,

[1] Reports of excavations of the Roman Military Station, Newstead, Melrose, by James Curle. Proceedings of the Society of Antiquaries of Scotland, 1906, 1907.

and one is justified in assuming that the vegetable remains from the same levels represent species of plants which were contemporaneous with the occupation of the site. In the case of the woods associated with tools as handles, one has, of course, no direct evidence as to their origin.

The general character of the various samples of earths from the pits and trenches, with the vegetable remains identified in each sample, is given in Table I.

Table II gives the results of my identification of the separate objects, such as tool handles.

In Table III I give a summary of the plant remains, arranged systematically according to the various natural orders to which the identified species belong.

General Remarks upon the Material Investigated.

I. Examination of Samples of Deposits from the Pits and Trenches.

(For detailed descriptions of the deposits *see* Table I.)

The plant remains identified among the samples are of three kinds :—

(1) Specimens of woods and twigs identified by microscopic examination of their wood structure ;
(2) Leaves and bark fragments recognised by their external appearance ;
(3) Seeds and fruits.

1. The results obtained by the examination of the numerous twigs and branches are somewhat disappointing. As an analysis of Table I shows, these results tend more to indicate the general prevalence of certain well-known indigenous trees—some probably pre-glacial—than to afford evidence of the presence in Britain at the period of the Roman occupation of this station of species of exceptional interest. Thus, although a great number of twigs and branches have been examined, and the species of plant to which they belong ascertained, I am only able as a result to tabulate some seven separate species of trees, and these are kinds which have always been considered to be indigenous.

The number of specimens which turned out to be hazel was remarkable. The bulk of the twigs and branches among the material from the pits were of this tree, although twigs and branches of birch also were fairly common. Oak was less frequently found, and in most instances the specimens of this wood were in the form of chips of large timber. This is interesting, because while hazel fruits and birch catkins were found, no acorns or small twigs of oak were discovered among the material submitted. It may be noted that pieces of oak bark were recognised, and Mr. Curle, in a letter to me, says that "oak must have been fairly plentiful, I think, at Newstead. All along the west side the early rampart appeared to lie on a double layer of oak branches." As Table II shows, ash was employed as shafts and handles of implements, but there is no evidence that it was procured locally. In two cases only was ash wood found not associated with implements. A piece of wood from Pit VIII[1] proved to be ash, and a portion about two inches long of a branch about an inch in diameter, without bark, was found among the earliest material received. These may have been pieces of broken or discarded implement handles. A few specimens of branches of the rowan (Pyrus Aucuparia) and of the white beam (Pyrus Aria) were found, and there seems little doubt that these trees have been wild in Scotland from very early times. One or two specimens of the wood of alder were encountered, and similarly a few of poplar (or willow.)

Thus it will be seen that the trees, recognised by the wood anatomy of twigs and branches, with portions of bark, which one may regard as growing locally at Newstead at the time of the occupation of the Roman Camp, number seven only :—oak, birch, hazel, willow or poplar, alder, rowan, white beam.

2. Leaves and the soft parts of plants were not sufficiently well preserved in most cases to enable one to identify them. However, a few remains of this nature were in fairly satisfactory condition, and among them I was able to identify leaves of hazel, leaves of birch, the stem and leaf-base of an umbelliferous plant, leaves of various grasses and sedges, leaves and flower parts of the common ling, stems and flower parts of nettles, the stems and leaves

[1] See Table II, Spec. No. 9.

of a species of dock, a frond of the common bracken, the rhizome and leaf rhachis of a fern, probably the species just mentioned, and several mosses and liverworts. The stem and leaf-sheath of the umbelliferous plant, I have every reason to believe, is that of cow parsnip (Heracleum Sphondylium), but a search for remains of fruits of this plant, the discovery of which would have done much to confirm my diagnosis, proved unsuccessful.

The pieces of bark recognised belong to the following species:—oak, birch, hazel, rowan.

My attention has been directed by Professor Bayley Balfour to a report on the vegetable remains found at the Lochlee Crannog, Tarbolton, Ayrshire, investigated by Mr. Robert Munro.

Mr. Munro's account of the excavations of this Crannog is in the Proceedings of the Society of Antiquaries of Scotland, Vol. XIII., and the report upon the vegetable remains by Professor Bayley Balfour supplies what appears to me to be some interesting comparisons between the plant remains of that site and those of the Newstead Roman Station.

The brushwood from below the log-pavement of the Lochlee Crannog was, it appears, composed of woods belonging to one or other of the following trees:—birch, hazel, alder, willow. The twigs and branches of the nature of bushwood found in the material from the Newstead site are chiefly hazel and birch, while twigs of alder and willow, although not plentiful, were also found.

Alder and willow are trees preferring damp situations, so that their occurrence, perhaps in some quantity, in the vicinity of the Lochlee Crannog at the time of its occupation is easily understood. Hazel and birch, with alder and willow more plentiful perhaps in moist situations, I am inclined to believe, were somewhat dominant trees in the primeval woods of North Britain.

This opinion is supported not only by the results of the examination of the material from Newstead and the records from the Lochlee Crannog, but also by the results of similar investigations which at various times I have made of the plant remains of other sites of Roman and pre-Roman occupation. Thus, to quote

the result of one such investigation only[1] :—of a number of logs from a pre-historic pile-structure in Wigtownshire which I examined in 1903, seven were, I found, birch, five alder, three hazel, one poplar (or willow), and one oak.

Oak recorded from Newstead, from the Lochlee Crannog, from the Wigtownshire pre-historic dwelling, and from many other Roman stations, appears to have occurred plentifully in primeval woods of North Britain, in which were also scattered trees of rowan and white beam.

It is rather remarkable that no specimens of coniferous wood have been found in the brushwood deposits either at Newstead or at the Lochlee Crannog, and the absence of beech wood from material from both stations is worth noting.

Other plant remains mentioned in the summary of plant remains from Newstead, and recorded also from the Lochlee Crannog, are portions of bracken fern, stems of heather, rhizomes of ferns, bark of birch, and hazel-nuts.

3. The number of seeds and fruits obtained from the Newstead deposits is not, I think, inconsiderable, especially when it is remembered that their occurrence in the material examined was to a certain extent accidental, and that it was impossible to select for seeds any special seed bearing deposits.

Among the samples which contained grain, the associated weed-seeds belong to plants characteristic at the present time of cultivated fields. The occurrence of seeds of Lychnis Githago in considerable quantity among the wheat-chaff (Sample C, Table I) is interesting, in that it indicates that a troublesome weed of cornfields in certain districts at the present day was also a pest in the corn crops of the Romans. The plant is essentially a weed of cultivation, and as such is usually considered to be a weed introduced into Britain with the cultivation of grain crops. In the east of Scotland, even at the present time, it is more a casual in cultivated areas than anything else, so that the occurrence of the seeds among the wheat-chaff from the Newstead station fixes its introduction as far back at least as the Roman occupation of this site. Other weeds of the same natural order associated with the cultivation of crops at the

[1] Ludovic Maclellan Mann, Pre-historic Pile-Structures in Pits. Proceedings of the Society of Antiquaries of Scotland, 1903.

present day, and represented by seeds among the material examined containing grain or wheat-chaff, are those of Stellaria media, Lychnis vespertina, Arenaria serpyllifolia, and what I believe to be a species of Cerastium. These plants at the present day are not so completely limited to cultivated fields as is Lychnis Githago, and some of them are probably indigenous. It is interesting to note that Mr. Reid, in his recent paper before the Linnean Society of London on the Pre-glacial Flora of Britain, figures and describes seeds of Stellaria media and Arenaria serpyllifolia from the pre-glacial deposits on the Norfork and Suffolk coasts.[1]

From the material containing wheat grains, fruits of three species of Compositæ were also found. Two of these I have identified as Cnicus arvensis and Picris hieracioides. Both are species common at the present day, and the latter is recorded as pre-glacial.[2] Ranunculus repens and Ranunculus bulbosus are likewise common wayside and meadow plants occurring at the present day in cultivated areas, and both the species were represented by fruits in the samples containing grain. Fruits of a third species of Ranunculus were found, but I have not so far been able to identify it. Among the same grain-yielding samples were found fruits of Polygonum aviculare, seeds of Geranium sp., Medicago lupulina, Chenopodium album, and fruits of a species of Rumex, probably R. Acetosella.

The absence of seeds and fruits of common trees, with the exception of those of hazel, finds its explanation probably in the character of the deposits examined. These were, I feel sure, in most cases the debris collected in refuse pits, and although small twigs and wood-chips are present, such are but a small proportion of the total debris, and represent, doubtless, scraps from clearings.

The plants represented by seeds and fruits in certain of the deposits are essentially those weeds which would quickly cover embankments and ditches of fortifications. Thus in some of the deposits we have fruits and seeds of many grasses and sedges, and of common weeds of waste places, such as Stellaria media, Arenaria serpyllifolia, Polygonum sp., Chenopodium sp., Poten-

[1] Reid, in Jour. Linn. Soc., vol. xxxviii (1908), p. 206.
[2] Reid, l. c.

tilla Tormentilla, and the two species of Ranunculus already referred to. Other weeds of this nature are Sinapis arvensis, Geranium sp., Mysotis sp., Urtica dioica, and various species of Rumex.

The seeds and fruits of other samples are of plants characteristic of thickets, and the presence of many twigs confirms the view that the deposits containing these are largely the scraps from forest clearings. Among such deposits I have recognised seeds of Solanum Dulcamara, Pedicularis palustris, fruits of Galeopsis Tetrahit, Urtica dioica, Rumex sp., and the fruits of many sedges. The fern remains also belong to these deposits.

Attention may be directed to the deposits containing brushwood in layers. In one instance a deposit of this character (Sample J, Table I) yielded seeds of characteristic moor-plants. Thus besides seeds of Calluna vulgaris, twigs of which formed the bulk of the brushwood in the deposit under review, I found the fruit parts of an Erica, berries and seeds of Empetrum nigrum, fruits of Rumex Acetosa, and those of several species of Scirpus and Carex. Besides the seeds mentioned, I found in this deposit leaves of a narrow-leaved grass, possibly Festuca ovina.

Where the brushwood laid on the clay was birch (Sample G, Table I) the seeds found were more varied in character, representing doubtless species that would form pioneers on freshly-made fortifications and embankments.

II. Woods of Implement Handles and other Articles.

(For detailed identifications, *see* Table II.)

Turning to the table giving the kinds of woods used for tool handles and other articles, one finds that those perhaps most commonly employed were ash and hazel. The latter wood figures as the shaft of a spear, as the shaft of a javelin, and as handles to tools. It doubtless recommended itself for these purposes on account of the clean and straight stems of moderate diameter and light weight obtainable. Hazel, though not durable, is fairly elastic. The value of ash for tool handles and the like is recognised at the present day.

Pyrus Aucuparia, used as a shaft for a hammer (No. 1, Table II), and also as a shaft for a gouge (No. 3, Table II),

was probably procured locally, for twigs of this species were found, in some cases with bark attached, among the material from the refuse pits. It is probable also that the birch used as a pick handle (No. 2, Table II) was similarly derived. Both birch and rowan are hard and tough woods which do not readily split.

One of the most interesting specimens submitted was a piece of basket-work made of the cleaned cores of stems of the hair-moss (Polytrichum commune). The stems of this moss are commonly a foot to eighteen inches long, and often attain a length considerably greater. The central stele, when cleaned, forms, as I have proved for myself, a tough pliable strand easily plaited, and quite suitable for the formation of such articles as baskets. When freshly cleaned, the core has a reddish colour and glossy surface, and basket work of the material would not only be quite strong, but would, at least at first, have an attractive appearance. I am indebted to Mr J. Masters Hellier, the curator of the Kew Museums, for particulars of articles made of this moss in the Kew Collections, and I give his list, as it supplies one with an idea of the use made of the moss in recent times.

LIST OF ARTICLES IN THE KEW MUSEUMS MADE OF HAIR MOSS, POLYTRICHUM COMMUNE, L.

1. Basket from near Wallington, Northumberland, received at Kew - - - - - - 1851.
2. Broom and brush, from Munich, received at Kew, 1858.
3. Hassock, from Yorkshire, " " " 1852.
4. Broom, from Sussex, " " " 1852.
5. Broom used by people at Hawkhead, near Windermere, received at Kew - - - 1855.

"A four-plied plaited object made of the long stems" of this hair-moss, and a "fringe-like structure made by plaiting together at one end" the long strands of the same moss, were found at the Lochlee Crannog.[1]

These records seem to indicate that a knowledge of the pliable and tough nature of the stems of this moss and of its usefulness

[1] Munro, in Proceedings of the Society of Antiquaries of Scotland, vol. xiii.

as a strand in the manufacture of plaited articles—a craft which the basket work from the Newstead Roman Station would indicate to have been appreciated, if not practised, by the Romans —must have been of greater antiquity than the period of the Roman occupation.

TABLE I.

Samples of Earth and Vegetable Remains from Pits and other Situations.

Sample A.—A dark vegetable earth containing a considerable number of pieces of chipped oak, evidently chippings of timber of some size. Mixed with other vegetable remains are twigs of hazel and birch in some quantity, the former being particularly numerous, while pieces of hazel bark are plentiful, some of the pieces being from trees of fair size. There is also a certain amount of charcoal and a piece of burnt bone. This sample yielded twigs of Pyrus Aucuparia with bark.

Sample B.—From this I obtained wood of Pyrus Aria, some of the branches being of fair size. The great bulk of the material consists of leaves of grasses matted and pressed together. The deposit is almost entirely of a vegetable nature, but the material is too much decomposed to determine its character. Many small wood chips, chiefly birch, are present, and pieces of birch bark.

Sample C.—This is a closely-caked mass of vegetable remains composed almost entirely of wheat-chaff. It appears to be the discarded refuse after winnowing and cleaning the grain, and indicates that the cleaning of the grain was carried on at Newstead. Among the chaff occur numerous seeds of Lychnis Githago, a troublesome weed of corn fields in some parts of Britain at the present time. Other weed-seeds from this sample are Stellaria media, Cerastium sp., Geranium sp., Medicago lupulina, fruits of Potentilla Tormentilla, Rumex Acetosella, Polygonum sp., and the fruits of several grasses.

Sample D.—A black deposit with numerous twigs and leaves. Leaves of hazel were identified, and several hazel nuts and pieces of hazel-nut shell were found, also catkins of hazel. The rhizome of a fern and the leaf rachis of a fern were identified. Grasses matted together form a large part of the deposit. The twigs and woods identified were hazel and birch.

Sample E.—This sample consists of a light-coloured clay with layers of a darker vegetable deposit running through it. Many grains of wheat and a little wheat-chaff were found. The sample proved one of the best for weed-seeds. It was carefully washed and the vegetable remains separated from the clay and sand. The fruits and seeds identified were those of Picris hieracioides, Cnicus

arvensis, Ranunculus repens, Ranunculus bulbosus, Polygonum sp., Polygonum aviculare, Rumex Acetosa, Urtica dioica, Chenopodium album, Potentilla Tormentilla, Lychnis Githago, Cerastium sp., Lychnis vespertina, Arenaria serpyllifolia, Stellaria media, several grasses, and a Carex. In addition there were present a number of small pieces of charcoal, some small chips of oak, and a few twigs of birch and hazel. An interesting feature was the presence of the remains of a large number of beetles.

Sample F.—A compost of vegetable matter much decomposed. It is made up almost entirely of a moss, probably a species of Hypnum. Birch-bark and hazel-bark, a branch of hazel, and hazel-nuts were identified. The material gave fruits of a Polygonum, fruits of a Carex, and fruits of one or two grasses. Seeds of Solanum Dulcamara, fruits of Urtica dioica, and fruits of Juncus effusus (?) were also identified.

Sample G.—A light-coloured clay with a definite layer of twigs all running one way, and for the most part all about $\frac{1}{4}$ of an inch in diameter. The twigs prove to be hazel and birch: one of the latter twigs with a catkin still attached. The clay on washing yielded the following:—Fruits of Ranunculus bulbosus, Ranunculus repens, Potentilla Tormentilla, seeds of Lychnis vespertina or allied species, Pedicularis palustris, fruits of Rumex obtusifolius, Rumex sanguineus, Polygonum Convolvulus, Urtica dioica, Scirpus setaceus, Scirpus sylvaticus, Carex sp., and several grasses, seeds of Atriplex sp., and Chenopodium sp.

Sample H.—A black earth with nothing sufficiently well preserved to permit of identification. (Pits in fore-ends.)

Sample I.—A black vegetable deposit. Chips of oak, twigs of birch, pieces of birch-bark, and a branch of rowan were identified. (Pits in fore-ends.)

Sample J.—This consists of masses of small twigs in a thick layer among light-coloured clay. The twigs are bundles of ling (heather), evidently brushwood cut and laid on the clay. Among the twigs were found flower-heads, leaves, and fruits of the heather. Other fruits or flower parts identified were those of Rumex Acetosa, Scirpus caespitosus, Scirpus sylvaticus, Carex sp., and Empetrum nigrum. Leaves of a grass, possibly Festuca ovina, were found.

Sample K.—A black vegetable deposit consisting almost entirely of moss. A few small pieces of birch-bark were noticed. From this sample came fruits of Urtica dioica, Rubus sp. (?), Galeopsis Tetrahit, Scirpus sylvaticus, Rumex sp., and leaves and fruits of several grasses. (Pits in fore-ends.)

Sample L.—A black deposit of vegetable origin. The remains were much decomposed, and nothing of interest sufficiently well preserved to be identified was discovered. (Pits in fore-ends.)

Sample M.—Clay soil, with a little dark earth, indicating vegetable remains. This was carefully washed and searched for seeds. Besides small bits of twigs and pieces of wood, fruits or seeds of the following were found:—Ranunculus bulbosus, Ranunculus

repens, Sinapis arvensis, Stellaria media, Stellaria Holostea, Potentilla Tormentilla, Polygonum sp., Rumex Acetosa, Rumex sanguineus, Scirpus sylvaticus, Urtica dioica, Chenopodium album, and another species of the last genus which was not identified. The sample yielded a few grains of wheat and one or two grains of what I believe to be barley.

Sample N.—A small cake of vegetable earth with a well-preserved frond of the common bracken. (Pits beneath east wall of buttressed end.)

Sample O.—A clay soil with a dark-coloured earth mixed with it. No vegetable remains of any size. The sample, after careful washing, gave fruits or seeds of the following:—Geranium sp., Myosotis sp., Polygonum Fagopyrum, Scirpus caespitosus, Scirpus setaceus, Rumex Acetosa, Rumex sp., Carex (several species), and fruits of several grasses.

Sample P.—A clay soil with a fair amount of vegetable earth. Seeds or fruits of the following were obtained after careful washing:—Ranunculus sp., Lychnis vespertina, Arenaria serpyllifolia, Pedicularis palustris, Potentilla Tormentilla, Rumex sanguineus, Rumex sp., Atriplex sp., Chenopodium sp., Urtica dioica, Urtica urens, Scirpus sylvaticus, and fruits of several species of Carex.

TABLE II.

Definite Objects received for Identification.

No. 1.	Shaft of hammer from Pit VIII.	Rowan (Pyrus Aucuparia).
2.	Shaft of pick.....	Birch (Betula alba).
3.	Shaft of gouge from Pit VIII...	Rowan (Pyrus Aucuparia).
4.	Fragment of a spear shaft from Pitt VIII.....	Hazel (Corylus Avellana).
5.	Shaft of an axe.....	Hazel (Corylus Avellana).
6.	Shaft of a large hammer.....	Hazel (Corylus Avellana).
7.	Handle of a chisel.....	Hazel (Corylus Avellana).
8.	Shaft of a large pick.....	Ash (Fraxinus excelsior).
9.	Wood from Pit VIII.....	Ash (Fraxinus excelsior).
10.	" " " "	Oak (Quercus Robur).
11.	Lining of a helmet.....	Wool mixed with fine clay.
12.	End of a shaft taken from the socket of a javelin head of iron, from ditch in earlier part of fort	Hazel (Corylus Avellana)
13.	Basket work made of the stems of	Hair moss (Polytrichum commune).
14.	Bast twisted as rope.....	(Not identified).

TABLE III.

Summary of Plant Remains Identified

In the Samples of Deposits from the Newstead Roman Station.

Ranunculaceae
Ranunculus repens—fruits
„ bulbosus—fruits
„ sp.—fruits
Cruciferae
Sinapis arvensis—seeds
Resedaceæ
Reseda lutea ?—seeds
Caryophylleæ
Lychnis Githago—seeds
„ vespertina—seeds
Stellaria Holostea—seeds
„ media—seeds
Arenaria serpyllifolia—seeds
Geraniaceae
Geranium molle ?—seeds
„ dissectum ?—seeds
Leguminosae
Medicago lupulina—seeds
Rosaceae
Alchemilla vulgaris—fruits
Potentilla Tormentilla—fruits
„ argentea—fruits
Fragaria vesca ?—fruits
Rubus sp.—fruits
Pyrus Aria—wood
„ Aucuparia—wood
Umbelliferae
Heracleum Sphondylium ?—stem and leaf base
Compositae
Picris hieracioides—fruits
Cnicus arvensis—fruits
Ericaceae
Calluna vulgaris—stems, leaves, flowers, fruits
Erica sp.—fruit parts
Oleaceae
Fraxinus excelsior—wood
Boragineae
Myostis sp.?—fruits
Lithospermum sp.?—fruits
Solanaceae
Solanum Dulcamara—seeds
Scrophularineae
Pedicularis palustris—seeds
Labiatae
Galeopsis Tetrahit—fruits
Chenopodiaceae
Chenopodium album—seeds
„ Sp.—seeds
Atriplex sp.—seeds
Polygonaceae
Rumex sanguineus — Perianth and fruit parts
Rumex obtusifolius — Perianth parts and fruits
Rumex Acetosella—fruits
„ Acetosa—fruits
Polygonum aviculare—fruits
„ Convolvulus—Perianth parts and fruits
Polygonum Fagopyrum ?—fruits
„ sp.—fruits
Empetraceae
Empetrum nigrum — seeds and fruit wall
Urticaceae
Urtica dioica—fruits
„ urens—fruits
Salicineae
Willow or Poplar—wood
Cupuliferae
Betula alba — catkins, bark, wood
Corylus Avellana—nuts, catkin, bark, wood
Quercus Robur—wood
Alnus glutinosa—wood
Juncaceae
Juncus effusus ?—fruits
„ squarrosus ?—fruits
Cyperaceae
Scirpus sylvaticus—fruits
„ caespitosus—fruits
„ setaceus—fruits
Carex (3 species not identified)—fruits

Gramineae
Several grasses, species not identified—fruits
Festuca ovina ?—leaves
Filices
Pteris aquilina — portion of frond
Fern sp.—portion of rhizome

Musci and Hepaticeae
Several kinds of Musci and Hepaticeæ were found but the species were not identified
One moss was undoubtedly a Hypnum and Polytrichum commune was used in the making of basket-work

Primulaceæ from Western Yunnan and Eastern Tibet.

BY

GEORGE FORREST.

With Plates XXVI—XLIII.

Many and interesting as are the specimens of Primulaceæ that have become known in recent years from Yunnan and Tibet, the forms which I describe below will serve to indicate that the area is yet far from being exhausted of novelties. Of the thirty-nine species of *Primula* in my collection enumerated here, fifteen are new; of seven species of *Androsace*, one is new; and of thirteen species of *Lysimachia*, three are new. Many of them are of great beauty and should be welcome additions to the hardy plants of gardens of this country, and I am glad to say that seedlings of several of the best of them have been raised and will probably be within reach of horticulturists in the course of this year (1908).

The most interesting amongst the known species of the collection are *P. vincaeflora*, *P. Delavayi*, and *P. Franchetii*, three of the four species at present constituting the remarkable section *Omphalogramma*, which takes its name from the oval and flattened form of the seed. Certainly no one with knowledge of the form of seed usually met with in *Primula* would suppose at first sight that the seed belonged to a species of that genus. Franchet, who described the bulk of the collections made by Père Delavay in the region from which the above came, was so struck by their singular appearance that he

formed of them a sub-genus of *Primula*, which Pax and Knuth, in their recent monograph of the order, retain as a section.

Each of the species mentioned has a distinct beauty of its own.

That with the largest flowers is *P. Franchetii.* Its blooms—solitary, as in all known species of the section—are fully two inches in length, and the expanded limb is almost two inches across, of a deep rich violet shading into the yellowish corolla-base.

P. Delavayi somewhat resembles the above, but is not nearly so imposing a plant, being smaller in every way, the deep fringing of the ruddy purple corolla segments being its conspicuous feature.

Both these species are generally found growing as solitary specimens in scattered groups.

P. vincaeflora is, in my opinion, as seen growing, the finest of the three. It is a much taller plant than the others, some specimens attaining a height of 14 inches or even more. Also, it grows in masses of 20 to 30 plants, a feature which enhances its beauty, and which I have never noted in the others. The flowers are of a deep indigo purple, the tube narrowly cylindrical, yellowish at base, the limb very widely spread, with the three upper lobes reflexed on the tube. This last peculiar character is not noticeable in dried specimens, and, probably for this reason, Franchet has not remarked on it in his description. Nevertheless it is quite constant, and is shown most perfectly in photographs of the species *in situ* taken by me. None of the many primulas I have seen can compare in beauty with this unique plant growing in its natural habitat, which is sheltered grassy openings in pine forests at an altitude of 10,000-11,000 ft. I should say it will prove perfectly hardy in this country, and will indeed be an acquisition.

The other two species I have mentioned grow at a greater altitude, generally from 12,000-13,000 feet, in moist and rocky, but not boggy, meadows, all three being commonly on chalky or limy soil.

It is interesting to note that the only other known species in the section is *P. Elwesiana*, from the Sikkim-Himalaya. The flora of the extension of the Himalaya mountains from that

point up to their entrance into Yunnan has, so far, been untapped, but almost certainly, once the country becomes more opened up, we shall have other and perhaps more beautiful species added to those mentioned.

Among the new species are many unique and beautiful forms, prominently *P. Littoniana* and *P. Forrestii.*

The former is a superb species of the section *Capitatae*, with flowers in densely-crowded spikes of 2-3 inches in length, each bearing hundreds of small, deflexed, fragrant blooms of a deep purplish-blue; but the remarkable feature of the species is the magnificent colouring of the calyces, which are of a vivid scarlet-crimson, and form a most striking contrast to the rich blue of the expanded flowers. The plants grow in crowded masses, generally in moist, grassy openings in pine forests at an altitude ranging from 10,000-11,000 feet.

P. Forrestii, of the section *Callianthae*, is a curious as well as a beautiful species, and a lover of dry stony situations. The flowers are large and numerous, of a rich deep shade of orange, and fragrant. The foliage is densely coated with glandular hairs, and, in the fresh state, has a peculiar, but not unpleasant, aromatic odour. The plant is specially adapted to the situation in which it is commonly found, *i.e.*, the crevices of dry, shady limestone cliffs, in having a long, intensely tough, woody root-stock of 2-3 ft. in length. The base of this is very tapered, generally only a few inches being enclosed in the crevices of the rocks. From this point the plant is pendulous for almost the full length of the remainder of the rootstock, a few inches of the growing apex being turned out and upwards. The rootstock for two-thirds of its length is covered with the induviæ of previous year's foliage, which, at the apex, form a dense matted mass, with the fresh foliage and flowers arising from the centre. Judging from the length of the rootstocks of specimens seen growing, allowing two whorls of leaves for one year's growth, a liberal estimate, some plants must reach the age of 50-100 years. Another feature which pointed to great age in the species was, the cliffs behind some of the larger specimens were scored and worn to the depth of fully an inch by the motion of the plants in the wind.

Another most interesting new species is *P. Bulleyana*. This is a tall moisture-loving plant of two, or in abnormal specimens fully three feet in height. In foliage it somewhat resembles *P. serratifolia*, Franch., but its special feature lies in the rich colouring of the flowers, which are of a deep reddish-orange shade, when in bud a velvety crimson, of large size, and in numerous dense whorls. Like most of the alpine or sub-alpine primulas, this species grows in huge colonies, and to see several acres densely covered with such plants is a sight ever to be remembered.

All the photographs from which the plates have been made to illustrate this paper were taken by Mr. Robert Adam, of the Royal Botanic Garden, excepting those taken by myself of the plants in their habitats.

PRIMULA.

Primula (Sinenses) obconica, Hance. Pax, Monog., p. 22.

Dry clefts of limestone cliffs on hills north of Yunnan-fu. Lat. 25° N. Alt. 7,000-9,000 ft. Yunnan, S.W. China. February, 1905. G. Forrest. No. 312.

Primula (Sinenses) Listeri, King. Pax, Monog., p. 24.

Plant of 4-8 inches. Flowers from rose-lavender to white according to situation; faintly fragrant. On moist, moss-covered ledges of cliffs, open or shady situations, in the side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 9,000-10,000 ft. April-May, 1906. W. Yunnan, China. G. Forrest. No. 1,815.

Plant of 4-8 inches. Flowers white, eye greenish-yellow, fragrant. Dry, rocky pasture land in the Yang-pi valley, western slopes of the Tali Range. Lat. 25° 30′ N. Alt. 7,000-9,000 ft. May, 1906. W. Yunnan, China. G. Forrest. No. 4,101.

Primula (Sinenses) langkongensis, G. Forrest. Sp. nov.
Plate xxvi.

Tota pube breviuscula vestita. Folia petiolata lamina late ovata 3-6 cm. longa 3-5 cm. lata obtusa basi late et profunde cordata sinuata crenata; petioli 6-11 cm. longi. Scapus crassus 12-25 cm.

altus umbellas 2-4 superpositas 2-4-floras gerens; bracteæ foliaceæ ovato-lanceolatae 5-8 mm. longae. Pedicelli 1-2 cm. longi. Calyx foliaceus late campanulatus sub anthesi 6-8 mm. longus post anthesin accrescens 8-13 mm. longus 9-12 mm. diametiens extus pubescens et glandulosus ad medium usque fissus lobis late ovatis irregulariter dentatis. Corollae tubus calycem superans basi cylindricus sursum in dimidio superiore infundibuliformis fauce annulato; limbus 2-2·5 cm. diam. lobis late obovatis bilobatis. Capsula globosa calyce multo brevior.

Open mountain pasture land on the divide between the Hochingcho and Lang-kong Hsien valleys. Lat. 26° 30′ N. Alt. 10,000-11,000 ft. August, 1906. N.W. Yunnan, China. G. Forrest. No. 2,779.

Allied to *P. malvacea*, Franch., but differing in the foliaceous, non-accrescent calyx, in the longer and expanded corolla tube, and the larger limb of the corolla.

(213) **Primula (Sinenses) cortusoides,** Linn., var. **lichiangensis,** G. Forrest. Var. nov. Plate xxvii.

Planta 15-35 cm. alta omnino pubescens sed praesertim super petiolos scapique partem infimum pube densissime vestita. Folia petiolata 5-8 cm. longa 3-5 cm. lata, ovato-oblonga profunde cordata, lobata dentataque; petioli 5-10 cm. longi. Scapus crassus 20-35 cm. altus, umbellam unam 5-8 floram rarius umbellas duas superpositas gerens; bracteae lanceolatae 5-10 mm. longae; pedicelli validi 1-2·5 cm. longi tomentosi. Flos fragrans. Calyx campanulatus 8-14 mm. longus alte fissus, lobis 8-9 mm. longis lanceolatis conspicue costatis foliaceis rigidis atrovirentibus glanduloso-pubescentibus praesertim versus basin. Corollae roseae faux virido-luteus; tubus calycem paullo superans 10-15 mm. longus sursum infundibuliformis; limbus 2-2·7 cm. lobis late obovatis bilobatis. Capsula oblonga glabra.

Plant of 6-14 inches. Flowers rich rose-red, almost crimson in specimens in shady situations; eye greenish-yellow, fragrant. On very steep, rocky slopes and ledges of inaccessible limestone cliffs in a very shaded side valley on the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 10,000-10,500 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,275.

This plant is very near *P. Veitchii*, Duthie, from which it differs in its inflated calyx-base, fewer flowers in the umbel, and the usually simple umbel; only rarely is there another one superposed. My plant, like *P. Veitchii*, is, I believe, only a form of the variable *P. cortusoides*, Linn.

This is a very handsome rock species, varying in the form of the foliage and the colour of the flowers, which range from light rose to almost crimson in some specimens. It delights in dry, shady places on the ledges of limestone crags and, though abundant enough in such situations, is local in its distribution.

Primula (Sinenses) septemloba, Franch. Pax, Monog., p. 30.

Plant of 8-18 inches. Flowers deep purplish-rose, fragrant. Moist, shady situations amongst scrub on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. July-August, 1906. W. Yunnan, China. G. Forrest. No. 1,811.

Plant of 7-14 inches. Flowers rose-crimson, semi-pendulous, fragrant. Shady, damp situations in mixed forests in side valleys on the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 10,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,276. Differs slightly in having the calyx not quite glabrous.

Primula (Monocarpicae) malacoides, Franch. Pax, Monog., p. 33.
Plate XXVIIIB.

Bunds of padi fields, and shady situations in the Hong-Ai and other surrounding valleys. Flowers rose-lavender. Lat. 25° 20′ N. Alt. 5,000-6,000 ft. January, 1905. S.W. Yunnan, China. G. Forrest. No. 399.

Growing apparently wild inside the city wall, Talifu. Lat. 25° 40′ N. Alt. 6,500 ft. January, 1905. W. Yunnan, China. G. Forrest, No. 399A.

Plant of 6-14 inches. Flowers rose-lavender, eye orange, fragrant. Dry and moist, open and shady situations in the Talifu valley. Lat. 25° 40′ N. Alt. 6,500-7,000 ft. September-October, 1906. W. Yunnan, China. G. Forrest. No. 1,802.

This is a charming plant, one of the finds of Père Delavay, but very local, only so far having been found in the Tali valley, around the city of that name, where it is abundant. It seems to thrive best in rather moist, sunny situations. It is new to cultivation, only this year having been raised from seed.

Primula (Monocarpicae) androsacea, Pax, Monog., p 34.

Growing profusely on bunds of padi fields in the Li Ho valley and others to the south. Flowers rose, with orange centre. Lat. 25° 18′ N. Alt. 6,000-8,000 ft. January, 1905. S.W. Yunnan, China. G. Forrest. No. 311.

Primula (Monocarpicae) minutiflora, G. Forrest. Sp. nov.
Plate XXIXB.

Annua (?) tota pube breviuscula vestita efarinosa. Folia petiolata lamina rotundato-ovata cordata 11-15 mm. longa 10-13 mm. lata prominenter regulariterque crenata; petioli 2-4 cm. longi. Scapus tenuis 4-8 cm. altus umbellam simplicem 4-5-floram vel umbellas 2 superpositas gerens; bracteae ovatae 4 mm. longae 2 mm. latae; pedicelli tenues 13-16 mm. longi. Calyx late campanulatus 3-5 mm. longus alte fissus, lobis ovatis obtusis extus rubro-luteis. Corollae pallide roseae tubus calycem aequans; limbus hypocrateriformis 6 mm. diametiens lobis late ovatis integris. Capsula globosa.

Borders of cultivation in the Hong Ai valley. Lat. 25° 30′ N. Alt. 5,000-6,000ft. January, 1905. W. Yunnan, China. G. Forrest. No. 310.

Allied to *P. androsacea*, Pax, but differing in being completely efarinose, in the broad bracts, the large, widely-spread calyx, and the entire lobes of the corolla.

Primula (Petiolares) petiolaris, Wall., var. **sulphurea,** Hook, fil. Pax, Monog., p. 41.

Growing amongst snow in pine forests on the ascent of the Niu Chang Pass, the eastern watershed of the Yangtze river. Lat. 27° 36′ N. Alt. 14,000 ft. December, 1904. N.W. Yunnan, China. G. Forrest. No. 304.

1359 **Primula (Petiolares) gratissima,** G. Forrest. Sp. nov.
Plate XXXB, XXXI.

Planta 5-10 cm. alta squamis vaginantibus plurimis late ovatis vel ovato-lanceolatis rubro-luteis densissime praesertim in primo evolutione farinosis basi cincta. Folia membranacea obovato-spathulata basi attenuata 7-9 cm. longa 2-3 cm. lata post flores evoluta irregulariter et late dentata glabra vel versus basin sparsim farinosa. Scapus robustus 5-8 cm. altus glaber vel sparsim farinosus, umbellam simplicem 4-10-floram gerens; bracteae ovatae vel ovato-lanceolatae acuminatae; pedicelli validi carnosi 10-14 mm. longi. Calyx sub anthesi anguste campanulatus 5-7 mm. longus, post anthesin late expansus, lobis inaequalibus late ovatis apice 2-3-dentatis. Corollae cyaneae tubus calycem longe superans 11-13 mm. longus infundibuliformis pallide flavido-albus ore flavido annulato praeditus; limbus 18-25 mm. diametiens, lobis late obovatis irregulariter et argute dentatis. Capsula globosa calycis tubo dilatato inclusa.

Plant of 2-4 inches. Flowers appearing before foliage is developed. Corolla bright blue, eye pale yellowish-white. Moist, rocky situations in beds of mountain streams, and on mountain meadows at verge of snow. Eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 11,500-13,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,167.

Plant of 3-5 inches. Flowers light or dark blue, eye and tube green. Moist, shady situations by sides of streams in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. July-August, 1906. W. Yunnan, China. G. Forrest. No. 1,808.

Plant of 2-4 inches. Flowers pure white, eye orange. Open mountain meadows on the edge of the snow-line near the summit of the Tali Range. Lat. 25° 40′ N. Alt. 13,000 ft. June, 1906. W. Yunnan, China. G. Forrest. No. 1,812. A variety with the flowers pure white.

Allied to *P. odontocalyx*, Franch., but differing in the large, densely farinose squamæ at base and the broader unequal bracts.

A charming alpine, and one of the first to show on the disappearance of the snows. In many instances I found specimens which had actually forced their way through the snow. In such cases the surrounding white showed to the greatest advantage the rich blue of the flowers. Situations very moist.

1305 **Primula (Petiolares) taliensis,** G. Forrest. Sp. nov. Plate xxxii.

Planta tota breviter hispida. Folia obovato-spathulata in petiolum late alatum attenuata 3-3·5 cm. longa 10-15 mm. lata alte et irregulariter serrata. Scapus robustus brevis foliis dimidio brevior sæpiusve minor umbellam simplicem 2-6-floram gerens; bracteae lanceolatae acutae 3-4 mm. longae; pedicelli validi erecti 12-16 mm. longi. Calyx campanulatus vel late infundibuliformis, tubo lobis late lanceolatis acuminatis triente longiore. Corollae tubus calycem longe superans 8-12 mm. longus basi cylindricus sursum paullo ampliatus fauce luteo; limbus paullo concavus 15-18 mm. diametiens, lobis albis vel pallide coeruleis late obovatis apice trilobatis. Capsula globosa calyce brevior.

Plant of 1-3 inches. Flowers white or very pale blue. Open stony pasture-land on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. September, 1906. W. Yunnan, China. G. Forrest. 1,805.

Distinct from any other species of the section in its pubescence, the smallness of all the parts, and the relatively large flowers.

1792

Primula (Bullatae) Dubernardiana, G. Forrest. Sp. nov.
Plate xxxiiiA.

Rhizoma crassum lignosum apice vestigiis foliorum anni praeteriti dense obtectum. Folia petiolata anguste spathulata in vaginam latam attenuata 5.5-6 cm. longa 8-10 mm. lata integra subtus sparsim farinosa supra glanduloso-pubescentia. Scapus 2-5 cm. altus leviter pubescens umbellam simplicem 3-5-florem gerens; bracteae lineari-lanceolatae 12-14 mm. longae; pedicelli tenues pubescentes 18-22 mm. longi. Calyx tubuloso-campanulatus basi densissime pubescens 9-10 mm. longus, lobis lanceolatis obtusis ciliatis tubo duplo-longioribus. Corollae pallide roseae tubus anguste infundibuliformis 10 mm. longus fauce luteo vel aurantiaco; limbus 2 cm. diametiens lobis late obcordatis alte emarginatis.

Dry situations on the ledges and in the clefts of cliffs on the eastern flank of the Mekong-Salwin divide, Mekong valley. Lat. 28° 6′ N. Alt. 8,000-9,000 ft. June-July, 1904. S.E. Tibet. G. Forrest. No. 308.

Allied to *P. bracteata*, Franch., and *P. Henrici*, Franch., but is distinct in having non-rugose entire leaves, the calyx deeply lobed, and much larger flowers.

A handsome and peculiar species, with a habit somewhat similar to *P. Forrestii*. The flowers are a beautiful shade of pale rose, the eye bright yellow, the plants generally forming dense cushions of one to two feet in diameter. I only found it in one place on dry shady ledges of inaccessible limestone cliffs; after much labour I secured many specimens, which, unfortunately, were lost later.

Named in honour of the late Père Dubernard, of the French R.C. Mission at Tsekou, in recognition of many services rendered.

1373

Primula (Bullatae) coerulea, G. Forrest. Sp. nov.
Plate xxxiv.

Folia petiolata ovata vel ovato-elliptica basi plus minusve attenuata apice rotundata 4-11 cm. longa 2-4 cm. lata sinuato-crenata ciliata subtus praesertim secus nervos lanata supra bullata glabra vel fere glabra atrovirentia; petiolus 1·5-4 cm. longus lana brunnea vel cinerea dense vestitus. Scapus 3-8 cm. altus plus minusve lanatus uniflorus interdum flores binos gerens; pedicelli 1-3 mm. longi. Calyx late campanulatus 8-14 mm. longus leviter pubescens lobis triangularibus acutis expansis tubum aequantibus vel super-

antibus. Corollae violaceo-coeruleae tubus infundibuliformis 1-1·2 cm. longus calycem paullo superans fauce viridi-luteo ; limbos 2·5-3 cm. diametiens expansus lobis late obovatis integris vel paullo emarginatis.

Plant of 2-3 inches. Flowers rich purplish-blue, eye and tube yellowish-green. Open, exposed situations on rocks in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. October, 1906. W. Yunnan, China. G. Forrest. No. 1,814.

Is nearest to *P. bullata*, Franch., but differs in the non-ligneous rhizome, in the dense pubescence of the under surface of the larger and broader leaves, the efarinose, pubescent and larger calyx, the larger flowers, and the spreading limb and almost entire lobes of the corolla.

A very rare plant, of which, unfortunately, seed was not procurable. Judging from the situation in which it was found, it must be exceptionally hardy, and with its beautiful, large, blue flowers would prove a valuable addition to the primulas already in cultivation.

Primula (Soldanelloideae) spicata, Franch. Pax, Monog., p. 70.

A slender plant of 4-8 inches. Flowers bright blue, faintly fragrant. Dry, rocky slopes and on ledges of cliffs in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000 ft. September-October, 1906. W. Yunnan, China. G. Forrest. No. 1,807.

Another of the many splendid plants discovered by Père Delavay. Of all the primulas there is not one can compare with this small species in airy gracefulness. The scapes are so slender they seem scarcely able to bear the weight of the relatively large flowers, which the slightest current of air sets trembling and swaying. It is a lover of dry, sunny situations, and is not by any means plentiful. It is annual, setting seed very rapidly and withering almost immediately.

Primula (Soldanelloideae) delicata, G. Forrest. Sp. nov.
Plate XXIXA.

Folia petiolata oblonga basi plus minusve attenuata 2-4 cm. longa 8-12 mm. lata irregulariter serrata subtus praesertim pubescentia. Scapus gracilis 3-7 cm. altus basi pubescens apice farinosus, spicam unilateralem farinosam gerens ; flores sessiles subpenduli. Calyx campanulatus 4 mm. longus lobis ovatis acutis. Corollae cyaneae tubus calyce brevior ; limbus campanulatus 4-5 mm. diametiens lobis ovatis apice dentatis.

Plant of 1-2 inches. Flowers deep blue. Dry, open situations on the eastern flank of the Tali Range. Lat. 25° 41′ N. Alt. 10,000-11,000 ft. August, 1906. W. Yunnan, China. G. Forrest. No. 1,804.

Allied to *P. spicata*, Franch., but differs in having all the parts smaller, and in the almost tubular corolla.

Primula (Farinosae) farinosa, Linn. Pax, Monog., p. 82.

Boggy ground at the head of the Chien-Chuan valley. Lat. 26° 30′ N. Alt. 8,000 ft. December, 1904. N.W. Yunnan, China. G. Forrest. No. 391.

Plant of 4-12 inches. Flowers pale rose, eye orange. Moist, open situations along the base of the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 8,000-9,000 ft. April-May, 1906. W. Yunnan, China. G. Forrest. No. 1,818.

Plant of 6-9 inches. Flowers pale rose-lilac, eye orange, fragrant. Moist, boggy situations by sides of streams in the Lichiang valley, south of the city. Lat. 26° 50′ N. Alt. 8,200 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,037.

Margins of streams and boggy places in thickets, north end of the Tsu-hsiong-fu valley. Lat. 25° N. Alt. 7,000 ft. January, 1905. S.W. Yunnan. G. Forrest. No. 307.

Very moist, clayey ground at the south end of the Lang Kong valley. Lat. 26° 12′ N. Alt. 7,000 ft. December, 1904. N.W. Yunnan, China. G. Forrest. No. 305.

Primula (Capitatae) denticulata, Smith. Pax, Monog., p. 90.

Plant of 4-8 inches. Flowers rose-lilac, faintly fragrant. Grassy situations on the margins of cane brakes on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 11,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,153.

Plant of 5-9 inches. Flowers lavender-blue, eye yellow, fragrant. Moist, open pasture-land by sides of streams on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. April-May, 1906. W. Yunnan, China. G. Forrest. No. 1,801.

Plant of 3-9 inches. Flowers lilac-blue, eye yellow, fragrant. Mountain pasture-land in the Yang-pi valley, on the western flank of the Tali Range. Lat. 25° 20′ N. Alt. 9,000-11,000 ft. April, 1906. W. Yunnan, China. G. Forrest. No. 4,096.

Primula (Soldanelloideae) pinnatifida, Franch. Pax, Monog., p. 66.

Plant of 2-7 inches. Flowers deep rich purplish-blue, fragrant. Moist, grassy situations on mountain slopes on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 12,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,398.

Another hardy alpine with beautiful fragrant blue flowers. The species blooms almost immediately on the disappearance of the snow, is local in its distribution, and rather rare.

Primula (Capitatae) nutans, Delavay. Pax, Monog., p. 94.

Ascent from Teng Chuan valley to pass leading to Sung Kwei. In shady pine forests, flowers rich blue. Lat. 26° 12′ N. Alt. 10,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 72.

Another gem of Delavay's discovering. This is a woodland species, but grows at a good altitude, and once introduced should prove quite hardy.

Primula (Capitatae) capitata, Hook. Pax, Monog., p. 94.

Open marshy places in pine forests on the ascent to the Kari Pass between Pung-tzu-la and Shi-zo. Fragrant. Lat. 28° 12′ N. Alt. 10,000-14,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 46.

Western slopes of the Kari Pass leading into the Chu-pa valley, between Pung-tzu-la and Shi-zo. Most delicately fragrant. Lat. 28° 12′ N. Alt. 13,000-14,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 303.

Primula (Capitatae) muscarioides, Hemsl., in Kew Bull. No. 8 (1907), p. 319.

On moist mountain meadows and banks of streams on the Mekong-Salwin divide west of Tsekou mission. Lat. 28° N. Alt. 10,000-11,000 ft. June-August, S.E. Tibet, 1904. G. Forrest. No. 306.

Moist ground, sides of streams, etc., on the Kari Pass, Yangtze-Mekong divide. Lat. 28° 12′ N. Alt. 11,000-12,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 313.

A delightful new species described in the Kew Bulletin by Mr. Botting Hemsley, from material grown from seed I collected in 1905. The plants do best in moist, shady situations, and grow in profusion in company with *P. sikkimensis* on the banks of mountain streams in S.E. Tibet.

Primula (Capitatae) Littoniana, G. Forrest. Sp. nov.
Plates XXXIIIB, XXXV, XXXVI.

Folia late lanceolata basi in petiolum late alatum attenuata apice rotundata 18-20 cm. longa 3·5-7 cm. lata irregulariter dentata utrinque hirsuta. Scapus crassus erectus 40-60 cm. altus vel altior basi glaber sursum farinosus spicam densam elongatam multifloram 7-12 cm. longam 2·5-3·5 cm. latam gerens; flores fragrantes perplurimi sessiles vel brevissime pedicellati reflexi; bracteae lineares farinosæ. Calyx late campanulatus 2-3 mm. longus alte fissus basi farinosus lobis coccineis ovatis vel ovato-lanceolatis acutis. Corollae violaceo-coeruleae tubus 6-7 mm. longus calycem multoties superans; limbus concavus 6-8 mm. diametiens alte fissus lobis anguste ovatis integris apice rotundatis. Capsula parva globosa calycem non superans.

Open mountain meadows on the range forming the eastern boundary of the Lichiang valley. Lat. 27° 12′ N. Alt. 10,000-11,000 ft. August, 1906. N.W. Yunnan, China. G. Forrest. No. 2,655.

Named to commemorate the late Consul Litton of Tengyveh, to whom I was much indebted for valuable assistance during my stay in China.

Primula (Tenellae) bella, Franch. Pax, Monog., p. 97.

Erect plant of 1-1¼ inches. Flowers rose-lavender, faintly fragrant. Damp, sandy mountain pasture-land on the Mekong-Salwin divide. Lat. 27° 28′ N. Alt. 14,000-15,000 ft. July-August, 1905. G. Forrest. No. 480.

Plant of 1½-2 inches. Flowers deep bluish-rose, eye white. On exposed rocks and ledges of cliffs near the summit of the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 12,000-13,000 ft. August, 1906. W. Yunnan, China. G. Forrest. 1,813.

Plant of 1-2½ inches. Flowers pale rose, eye greenish-white, faintly fragrant. Dry, shady situations on cliffs in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 9,000-10,000 ft. September, 1906. G. Forrest. No. 1,803.

Plant of one inch. Flowers deep, rich purplish-blue. On a patch of peaty soil on a barren limestone ridge at the extreme limit of vegetation on the eastern flank of the Lichiang Range. Lat. 27° 30′ N. Alt. 16,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,399.

Primula (Tenellae) yunnanensis, Franch. Pax, Monog., p. 97.

Plant of 2-3 inches. Flowers rose-pink, faintly fragrant. Dry, open situations on bare slopes on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. September, 1906. W. Yunnan, China. G. Forrest. No. 1,817.

Plant of 2-4 inches. Flowers rose-red, fragrant. In crevices of dry, shady rocks and cliffs on the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 10,500-12,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,059.

1824

Primula (Tenellae) congestifolia, G. Forrest. Sp. nov.
Plate XXVIIIA.

Perennis. Rhizoma vestigiis foliorum anni praeteriti obtectum. Folia petiolata late ovata 7-9 mm. longa 5-6 mm. lata in petiolum 1 cm. longum late alatum attenuata revoluta crenata subtus dense farinosa supra vix pubescentia. Scapus crassus 2-2·5 cm. altus puberulus 1-3-florus; flores sessiles vel brevissime pedicillati pedicillis 1-2 mm. longis farinosis paullo deflexis; bracteae ovato-lanceolatae 5-6 mm. longae acutae brunneo-virides glabrae intus sparsim farinosæ. Calyx poculiformis 7 mm. longus alte fissus lobis ovatis obtusis. Corollae roseae tubus anguste infundibuliformis calycem vix superans fauce annulato; limbus 1-3·2 cm. diametiens paullo patens lobis ovatis bilobatis.

Plant of 1-2½ inches. Flowers bright rose-red, non-fragrant. On open, wind-swept limestone ridges on the Mekong-Salwin divide. Lat. 27°-28° N. Alt. 13,000-15,000 ft. July-August, 1905. S.E. Tibet. G. Forrest. No. 478.

A beautiful dwarf perennial with brilliantly-coloured flowers, and one of the hardiest species seen. Growing to perfection in the most exposed situations. Rare and local.

1615

Primula (Tenellae) longituba, G. Forrest. Sp. nov.
Plate XXXVII.

Perennis parva glabra. Folia ovata vel late obovata 2·5-4 cm. longa 1-2·2 cm. lata in petiolum alatum attenuata biserrata subtus

dense supra sparsim farinosa. Scapus tenuis 1·5-4 cm. altus farinosus umbellam simplicem 1-5-floram gerens; bracteae lineari-lanceolatae; pedicelli 2-8 mm. longi farinosi bracteolas paucas gerentes. Calyx campanulatus 3-5 mm. longus dense farinosus alte fissus lobis lanceolatis acutis. Corollae tubus flavido-viridis anguste infundibuliformis 1-1·4 cm. longus calycem multoties superans; limbus coeruleo-roseus paullo concavus 14-16 mm. diametiens lobis obovatis paullo emarginatis. Capsula ovoidea parva calycem paullo superans.

Plant of $1\frac{1}{2}$-$2\frac{1}{2}$ inches. Flowers bluish-rose, eye and tube green, fragrant. Moist, shady situations on moss-covered rocks and cliffs in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. August-September, 1906. W. Yunnan, China. G. Forrest. No. 1,809.

Allied to *P. yunnanensis*, Franch., but differing in the broader and densely farinose leaves, the farinose scape and inflorescence, in the short bracteoles, and much shorter pedicels, the smaller and more numerous flowers, and the slightly emarginate lobes of the corolla.

Primula (Nivales) sikkimensis, Hook. Pax, Monog., p. 100.

Mekong-Salwin divide to the west of Tsekou mission. Lat. 28° 10′ N. Alt. 10,000-11,000 ft. S.E. Tibet, July, 1904. G. Forrest. No. 400.

Plant of 12-18 inches. Flowers bright canary-yellow, fragrant. Crevices and ledges of limestone cliffs on the eastern flank of the Lichiang Range. Lat. 27° 20′ N. Alt. 11,000-12,000 ft. July, 1906. N.W. Yunnan, China. G. Forrest. No. 2,642.

Primula (Nivales) nivalis, Pallas,
var. **macrophylla** (Don) Pax, Monog., p. 103.

Plant of 4-9 inches. Corolla deep rose-lavender, eye and tube green, thick and fleshy; fragrant. Moist, open situations on mountain meadows on the summit of the Tali Range. Lat. 25° 40′ N. Alt. 12,000-13,000 ft. September-October, 1906. W. Yunnan, China. G. Forrest. No. 1,820.

var. **sinensis,** Pax, Monog., p. 104.

Plant of 6-12 inches. Flowers deep rose-lavender, eye greenish-lavender, fragrant. Moist mountain pasture-land on the eastern

flank of the Lichiang Range. Flowering successively, always near the snow-line. Lat. 27° 12′ N. Alt. 10,000-13,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,128.

Plant of 12-24 inches. Flowers rich purplish-crimson. Forming masses in open pasture-land on the eastern flank of the Lichiang Range. Lat. 27° 20′ N. Alt. 11,000-12,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,254.

Primula (Nivales) pulchella, Franch. Pax, Monog., p. 104.

Plant of 4-7 inches. Flowers semi-pendulous, purplish-blue, fragrant. Shady, grassy situations in pine forests at the base of the eastern flank of the Lichiang Range. Lat. 27° 20′ N. Alt. 10,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,480.

Primula (Omphalogramma) Franchetii, Pax, Monog., p. 108.

Moist rocky situations on mountain meadows on the Mekong-Salwin divide to the N.W. of Tsekou mission. Lat. 28° 12′ N. Alt. 10,000-12,000 ft. S.E. Tibet. July-August, 1904. G. Forrest. No. 685.

Primula (Omphalogramma) vincaeflora, Franch. Pax, Monog., p. 108. Plate XXXA.

Plant of 16-14 inches. Flowers deep indigo blue, non-fragrant. Moist, shady situations on grassy openings in pine forests on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 10,000-11,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,234.

Primula (Omphalogramma) Delavayi, Franch. Pax, Monog., p. 110.

Plant of 3-6 inches. Flowers, tube yellowish at base, limb deep rose-purple. Moist, open mountain meadows on the summit of the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 12,000-13,000 ft. September, 1906. W. Yunnan, China. G. Forrest. No. 4,097.

1288 **Primula (Callianthae) Forrestii,** Balf. fil. Sp. nov. Plates XXXVIII, XXXIXB.

Rhizoma crassum lignosum 20-80 cm. longum basi nudum sursum vestigiis foliorum anni praeteriti obtectum. Fragrans;

praeter corollam dense glanduloso-pubescens. Folia petiolata ovato-elliptica basi subcordata vel attenuata irregulariter bicrenata subtus dense farinosa supra rugosa, infima rosulata reflexa 3-4 cm. longa 1·5-3 cm. lata cum petiolo 2-3 cm. longo expanso subvaginato et farinoso, superiora erecta expansa 9-20 cm. longa 3·5-6 cm. lata cum petiolo 4-10 cm. longo basi expanso. Scapus validus erectus 8-23 cm. longus folia aequans vel superans umbellam 10-25-floram gerens; bracteae foliaceae late lanceolatae 1-3 cm. longae 7-10 mm. latae integrae; pedicelli erecti tenues 1-4 cm. longi. Calyx poculiformis vel paullo campanulatus 10-15 mm. longus per trientem fissus lobis late ovatis apice rotundatis. Corollae tubus pallide aurantiaco-luteus basi cylindricus sursum infundibuliformis 14 mm. longus fauce intense aurantiaco; limbus 2 cm. diametiens lobis aurantiaco-luteis late ovatis vel rotundatis alte emarginatis. Capsula ovoidea calyce multo minor et eodem inclusa.

Plant of 6 inches to 3 feet. Rootstock woody. Flowers deep yellow with an orange eye; flowers and foliage fragrant. Pendulous from dry, shady crevices of limestone cliffs on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 9,000-11,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,117.

Primula (Callianthae) vittata, Bureau et Franch. Pax, Monog., p. 118.

Plant of 6-12 inches. Flowers deep rose-red. Forming masses on steep, grassy slopes on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 11,000-12,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,283.

Primula (Callianthae) amethystina, Franch. Pax, Monog., p. 118.

Plant of 3-6 inches. Flowers deep purplish-blue, fragrant. Moist, open mountain meadows near, and on the summit of, the Tali Range. Lat. 25° 40′ N. Alt. 12,000-13,000 ft. September-October, 1906. W. Yunnan, China. G. Forrest. No. 1,806.

1437 **Primula (Callianthae) brevifolia,** G. Forrest. Sp. nov. Plate xl.

Glabra efarinosa. Folia papyracea latissime ovato-elliptica in petiolum brevem alatum attenuata 2·5-5 cm. longa 1·5-2·5 cm. lata serrata. Scapus gracilis 8-19 cm. altus folia multoties superans umbellam subpendulam unilateralem 4-12-floram gerens; flos

fragrans; bracteae parvae late lanceolatae acutae; pedicelli 5-14 cm. longi. Calyx purpureo-viridis 5 mm. longus ad medium fere fissus lobis late lanceolatis acutis. Corollae cyaneae late infundibuliformis tubus calycem aequans vel superans; limbus 7-10 mm. diametiens lobis brevibus latis alte et irregulariter emarginatis.

Erect plant of 3-7 inches. Flowers semi-pendulous, deep blue, faintly fragrant. On open, damp mountain pasture-land on the Mekong-Salwin divide. Lat. 27°-28° N. Alt. 14,500-16,000 ft. July-August, 1905. S.E. Tibet. G. Forrest. No. 476.

Allied to *P. amethystina*, Franch., but differing in being taller and more delicate, in the form and incision of the leaves, the more numerous flowers, and the narrower and irregularly-lobed corolla.

Primula (Callianthae) biserrata, G. Forrest. Sp. nov. Plate xli.

Glabra. Folia membranacea oblanceolata in petiolum scariose alatum attenuata 12-20 cm. longa 2·5-5 cm. lata irregulariter biserrata. Scapus 20-29 cm. altus folia superans umbellam simplicem vel umbellas duas superpositas semipendulas 5-12-floras gerens; flos fragrans; bracteae lanceolatae acutae vel fissae 5-11 mm. longae; pedicelli 1-2·5 cm. longi. Calyx late campanulatus 7-10 mm. longus ad medium fere fissus lobis late lanceolatis apice plus minusve fissis. Corollae tubus e basi ampliatus fauce aurantiaco annulato; limbus 2-2·5 cm. diametiens alte fissus lobis sulphureis macula aurantiaca centrali notatis rotundatis obscure emarginatis margine irregularibus.

Plant of 7-14 inches. Flowers pale yellow, with the centre of each petal marked orange; faintly fragrant. Open situations on the margins of pine forests on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. July-August, 1906. W. Yunnan, China. G. Forrest. No. 1,816.

Plant of 9-15 inches. Flowers yellow, with an orange stripe down centre of each segment of corolla; fragrant. Open mountain meadows on the eastern flank of the Lichiang Range. Lat. 27° 15′ N. Alt. 11,000-13,000 ft. September, 1906. N.W. Yunnan, China. G. Forrest. No. 2,974.

Mekong-Salwin divide to the N.W. of Tsekou mission. Lat. 28° 12′ N. Alt. 10,000-11,000 ft. June-July, 1904. S.E. Tibet. G. Forrest. No. 4,100.

Allied to *P. obtusifolia*, Royle, but differing in the entirely glabrous leaves, the long lanceolate bracts, the divided apices of

these and the lobes of the calyx, in having occasionally two umbels, in the larger number and semi-pendulous habit of the flowers, the gradual expansion of the corolla tube, the yellow colour of the corolla, and the irregular margins of the lobes.

A hardy and graceful alpine, with large flowers beautifully shaded from pale sulphur to orange yellow. It is a lover of shady pine forests at the highest altitudes, on the margins of which it forms scattered colonies. Soil free and stony, but not moist.

Primula (Cankrienia) Poissonii, Franch. Pax, Monog., p. 128.

In moist places, generally bog, in the Lichiang and Hoching valleys. Plant of 1-2½ ft. Flowers deep rose. Lat. 26°-27° 30′ N. Alt. 7,000-9,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 355.

Plant of 1-2 ft. Flowers deep purplish-crimson, eye orange, faintly fragrant. Open, boggy meadows on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-12,000 ft. August, 1906. W. Yunnan, China. G. Forrest. No. 1,819.

Erect plant of 1-3 ft. Flowers rich crimson-lake, eye orange. In drying the colour changes to pale magenta. Moist and boggy situations at the north end of the Lichiang valley. Lat. 27° 10′ N. Alt. 8,000-9,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,120.

1406 **Primula (Cankrienia) Bulleyana,** G. Forrest. Sp. nov.
Plates xxxixA, xlii.

Folia papyracea ovato-lanceolata apice rotundata vel acuta, in petiolum breviter alatum attenuata 12-17 cm. longa 3-4 cm. lata argute et irregulariter dentata subtus leviter hispida supra glabra Scapus elatus validus 40-70 cm. altus versus apicem farinosus umbellas 5-7 superpositas 15-17-floras inter se post anthesin 8-11 cm. distantes gerens; flos fragrans; bracteae lineares 1·5-3 cm. longae juveniles sparsim farinosæ; pedicelli validi mox cernui post anthesin erecti sparsim farinosi bracteas aequantes vel eisdem breviores. Calyx campanulatus sub fructu poculiformis 4-5 mm. longus ad medium usque fissus lobis late triangularibus sursum subulatis extus pallide viridibus lineis albidis intersepalinis striatis intus farinosis Corollae tubus cylindricus sursum infundibuliformis fauce annulato; limbus 2 cm. diametiens lobis intense aurantiaco-luteis extus rubro-fuscis late obovatis fere rotundatis. Capsula ovoidea calycem paullo superans.

Plant of 1½-2½ ft. Flowers deep reddish-orange, in bud deep brownish-crimson, faintly fragrant. Moist, open situations on mountain meadows on the eastern flank of the Lichiang Range. Lat. 27° 25′ N. Alt. 10,000-11,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,440.

Named in honour of Mr. A. K. Bulley of Ness, Neston, Cheshire, for whom I collected.

Primula (Cankrienia) serratifolia, Franch. Pax, Monog., p. 126.

Plant of 1-2 ft. Flowers rich pale rose, crushed strawberry shade. Moist, open situations on mountain meadows on the eastern flank of the Lichiang Range. Lat. 27° 25′ N. Alt. 10,000-11,000 ft. June, 1906. N. W. Yunnan, China. G. Forrest. No. 2,449.

Plant of 1-2 ft. Flowers rose-carmine with yellow eye, fragrant. Moist, open situations by the sides of ditches and streams on plain at north end of the Lichiang valley. Lat. 27° 10′ N. Alt. 9,000 ft. May, 1906. N. W. Yunnan, China. G. Forrest. No. 2,194.

My specimens differ slightly from the above in having the bracts as long or longer than the pedicels, 2-3 cm. long, and the flowers and calyces smaller. Also in No. 2,194 the upper part of the scape, the bracts, and the pedicels are farinose in the young state.

ANDROSACE.

Androsace (Pseudoprimula) alchemilloides, Franch. Pax, Monog., p. 180.

Plant of 1-2½ inches. Flowers pure white, fragrant. Ledges of limestone cliffs and on humus-covered boulders on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 11,000-12,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,228.

Androsace (Chamaejasme) spinulifera, Franch. Pax, Monog., p. 184. Plate xliiiB.

Erect plant of 3-10 inches. Flowers rose-pink, eye yellow. Very dry, barren, stony grassland at the north end of the Lichiang plain. Lat. 27° 5′ N. Alt. 8,500 ft. May, 1906. N. W. Yunnan, China. G. Forrest. No. 2,081.

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Androsace (Chamaejasme), Bulleyana, G. Forrest. Sp. nov.
Plate xliiiA.

Biennis radice crassa lignosa multicipite. Folia dense rosulata spathulata 12-30 mm. longa 4-7 mm. lata sessilia mucronata coriacea glauca margine cartilaginea ciliata. Scapi numerosi erecti validi 5-12 cm. alti pubescentes eorum quisque umbellam 5-12-floram dense pubescentem gerens; bracteae lanceolatae acutae 4-7 mm. longae; pedicelli plus minusve inaequales 8-22 mm. longi. Calyx turbinatus vel paullo campanulatus 3-4 mm. longus ad medium fissus lobis ovato-lanceolatis obtusis. Corollae miniatae hypocrateriformis tubus calycem aequans fauce prominenter annulato; limbus 6-10 mm. diametiens lobis late obovatis integris Capsula ovoidea.

Dry, rocky hillsides on the descent from the Chung Tien plateau to the Yangtze valley near Tang Tui. Flowers bright vermillion. Lat. 28° 12′ N. Alt. 10,000 ft. September, 1906. N.W. Yunnan, China. G. Forrest. No. 108.

Allied to *A. Aizoon*, Duby, var. *coccinea*, Franch., but differing in the pubescence of all the parts, the larger leaves and corolla limb, the prominent annulus, and the 5-fid capsule.

Androsace (Chamaejasme) mucronifolia, Watt. Pax, Monog., p. 188.

Plant of 6-15 inches. Flowers rose-pink. Forming dense masses in dry, exposed situations on the ledges of cliffs and on limestone drift on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 9,500-11,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,127.

Androsace (Chamaejasme) Chamaejasme, Host. Pax, Monog., p. 188.

Tufted plant of 2-4 inches. Flowers pale rose, eye a deeper shade. Dry, exposed situations amongst rocks on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. July, 1906. W. Yunnan, China. G. Forrest. No. 1,810.

Plant of 1-2 inches. Flowers bright rose-red. Forming dense masses in stony, sandy, moist situations on the slopes of the Mekong-Salwin divide. Lat. 27°-28° N. Alt. 11,000-13,000 ft. July-August, 1905. S.E. Tibet. G. Forrest. No. 477.

Androsace (Aretia) Delavayi, Franch. Pax, Monog., p. 201.

Plant of one inch. Flowers pale rose, occasionally white, eye yellow. Forming dense cushions on humus-covered boulders at the edge of the snow-line on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 12,000-13,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,319.

Androsace (Andraspis) erecta, Maxim. Pax, Monog., p. 209.

Dry, rocky hillsides on the descent from the Chung Tien plateau to the Yangtze valley, near Tang Tui. Flowers rosy white. Lat. 28° 12′ N. Alt. 10,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 121.

Plant of 6-9 inches. Flowers white or pink. Dry, barren, rocky pasture-land at the base of the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 8,500-9,000 ft. August, 1906. N.W. Yunnan, China. G. Forrest. No. 2,738.

LYSIMACHIA.

Lysimachia (Nummularia) Hemsleyana, Maxim. Pax, Monog., p. 259.

Moist ground by the sides of padi fields, etc., in the Teng Chuan and Hoching valleys. Lat. 26°-26° 30′ N. Alt. 7,000-8,500 ft. N.W. Yunnan, China. G. Forrest. No. 82.

Slender plant of 9-12 inches. Flowers yellow. Dry, open situations amongst grass in side valleys on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. W. Yunnan, China. G. Forrest. No. 3,842.

Lysimachia (Lerouxia) deltoidea, Wight, var. **cinerascens,** Franch. Pax, Monog., p. 263.

Plant of 2-4 inches. Flowers yellow. Open, dry, rocky situations amongst scrub on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 9,000-10,000 ft. July, 1906. W. Yunnan, China. G. Forrest. No. 3,843.

Plant of 2-6 inches. Flowers canary yellow. Dry, stony, open situations amongst dwarf scrub on the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 10,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,265.

Lysimachia (Lerouxia) drymariaefolia, Franch. Pax, Monog., p. 264.

Semi-prostrate plant of 1-1½ ft. Flowers yellow. Shady, grassy situations in and on the margins of pine forests on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 11,000-12,000 ft. August-September, 1906. W. Yunnan, China. G. Forrest. No. 3,841.

Lysimachia (Ephemerum) bracteata, G. Forrest. Sp. nov.

Planta tota pubescens procumbens vel erecta 30-40 cm. alta stolones breves emittens. Folia omnia opposita petiolata late lanceolata obtusa 9-11·5 cm. longa 3-4 cm. lata in petiolum 2-2·5 cm. longum attenuata integra. Racemus laxus subpendulus bracteatus; bracteae foliaceae lanceolatae 2-3 cm. longae 5-10 mm. latae; pedicelli 2-3 cm. longi. Calyx 6-8 mm. longus ad basin usque fissus lobis anguste lanceolatis dense pubescentibus. Corolla flava late companulata 1 cm. longa intus glandulosa alte lobata lobis late ovatis obtusis vel subacutis. Stamina corolla breviora filamentis basi connatis. Ovarium pilosum stylo corollam aequante staminibus longiore.

Plant of 1-3 ft. Shady thickets on hills to the west of Yunnan-fu. Lat. 25° N. Alt. 7,000-8,000 ft. February, 1905. S.E. Yunnan, China. G. Forrest. No. 571.

Resembles in some parts *L. Franchetii*, R. Knuth, but is excluded from the section to which that species belongs by its loosely racemose inflorescence, yet is quite distinct in the section Ephemerum.

Lysimachia (Ephemerum) barystachys, Bunge. Pax, Monog., p. 289.

Plant of 12-16 inches. Flowers white, anthers violet. Dry, barren, stony ground at the base of the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 8,500-9,000 ft. July, 1906. N.W. Yunnan, China. G. Forrest. No. 2,515.

Lysimachia (Ephemerum) lobelioides, Wall. Pax, Monog., p. 296.

Plant of 6-10 inches. Flowers white. Open, moist, grassy situations along the base of the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 7,000-9,000 ft. May, 1906. W. Yunnan, China. G. Forrest. No. 3,838.

Lysimachia (Ephemerum) Delavayi, Franch. Pax, Monog., p. 297.

Plant of 1-3 ft. Flowers pinkish-white, anthers violet. Dry, open situations in side valleys on the eastern flank of the Tali Range, Lat. 25° 40′ N. Alt. 9,000-10,000 ft. August-September, 1906. W. Yunnan, China. G. Forrest. No. 4,120.

Lysimachia (Ephemerum) violascens, Franch. Pax, Monog. p. 297.

Dry limestone hillside on ascent of pass between Teng Chuan and Sung Kwei valleys. Flowers pinkish. Lat. 26° N. Alt. 8,000-10,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 447.

Plant of 2-4 ft. Flowers white or shell-pink, anthers violet. Dry, open situations amongst scrub on the eastern flank of the Tali Range. Lat. 25° 40′ N. Alt. 10,000-11,000 ft. September-October, 1906. W. Yunnan, China. G. Forrest. No. 3,839.

Lysimachia (Ephemerum) candida, Lindl.,
sub-spec. **eucandida,** R. Knuth. Pax, Monog., p. 300.

Common amongst opium crop. Hong Ai valley. Lat. 25° 30′ N. Alt. 5,000-6,000 ft. S.W. Yunnan, China. G. Forrest. No. 456.

sub-spec. **microphylla,** Franch. Pax, Monog., p. 301.

Plant of 4-6 inches. Flowers white. Marshy situations on the bunds of padi-fields in the Yung Chang valley. Lat. 25° 6′ N. Alt. 5,500 ft. April, 1906. W. Yunnan, China. G. Forrest. No. 4,103.

Plant of 6-8 inches. Flowers white, anthers violet. Marshy, open situations by sides of streams in the Yang-pi valley. Lat. 26° 30′ N. Alt. 5,000 ft. May, 1906. W. Yunnan, China. G. Forrest. No. 4,104.

Plant of 6-10 inches. Flowers white. Damp, grassy situations in the padi fields around the city of Talifu. Lat. 25° 40′ N. Alt. 6,500 ft. April-May, 1906. W. Yunnan, China. G. Forrest. No. 3,840.

850 **Lysimachia (Ephemerum) longisepala,** G. Forrest. Sp. nov.

Planta tota pube densa breveque fumosa vestita. Caulis erectus 30 cm. altus. Folia omnia opposita lanceolata 3-5 cm. longa 8-13 mm. lata subacuta integra subtus cinerea supra viridia, superiora in petiolum brevem attenuata, inferiora sessilia et semiamplexicaulia. Racemus bracteatus brevis 6-7 cm. longus; bractae lanceolatae acutae pedicellos floresque aequantes vel superantes; pedicelli tenues erecti 8-16 mm. longi. Calyx 8 mm. longus ad basin usque fissus lobis anguste lanceolatis acutis dense pubescentibus glandulosisque. Corolla aurantiaca late campanulata alte lobata lobis late ovatis obtusis integris glandulosis. Stamina inaequalia corolla paullo breviora; filamentis ultra medium connatis tubum dense glandulosum formantibus. Stylus stamina paullo superans. Capsula globosa calyce multo brevior.

Boggy ground, such as the sides of padi-fields, etc., in the Sung Kwei valley. Lat. 26° 5′ N. Alt. 8,000 ft. September, 1904. N.W. Yunnan, China. G. Forrest. No. 426.

A distinct species resembling none of the species in the section to which it belongs.

960 **Lysimachia (Ephemerum) lichiangensis,** G. Forrest. Sp. nov.

Planta glabra erecta 35-50 cm. alta subsimplex vel et basi ramosa caulibus obscure striatis. Folia papyracea alterna lanceolata acuminata 3-5 cm. longa 6-14 mm. lata basi anguste attenuata, paullo amplexicaulia et decurrentia supra atrovirentia subtus pallidiora utrinque glandulis rubris praesertim marginibus crispatis incrassatisque punctata et vittata. Racemus bracteatus simplex vel ramosus flores carneo-albos venulis roseis striatos sub antheis suberectos post anthesin erectos gerens; bracteae lineari-lanceolatae pedicellos superantes; pedicelli 4-5 mm. longi. Calyx corollam fere aequans ad basin usque fissus lobis albis anguste lanceolatis acuminatis apice paullo recurvis lineis duabus longitudinalibus rubro glandulosis notatis margine membranaceis. Corolla late campanulata 6-8 mm. longa alte lobata tubo intus dense glanduloso lobis late spathulatis apice rotundatis integris. Stamina paullo exserta basin loborum corollae affixa filamentis versus basin glandulosis; antheris sparsim glandulosis. Stylus glaber staminibus brevior. Capsula globosa glabra calycem aequans vel eodem paullo brevior.

Plant of 1-2 ft. Flowers pinkish-white. Shady, rocky situations at the base of cliffs on the eastern flank of the Lichiang Range. Lat. 27° 12′ N. Alt. 9,000-10,000 ft. June, 1906. N.W. Yunnan, China. G. Forrest. No. 2,352.

Allied to *L. decurrens*, Forst., var. *platypetala*, Franch., but differing in the height, the smaller and glandular leaves, shorter petioles and pedicels, the colour of the flower, and the short style.

Lysimachia (Ephemerum) humifusa, R. Knuth.

Prostrate plant of 4-8 inches. Flowers red or pink. Dry, open, grassy situations amongst scrub on the eastern flank of the Lichiang Range. Lat. 27° 10′ N. Alt. 9,000-10,000 ft. May, 1906. N.W. Yunnan, China. G. Forrest. No. 2,068.

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Unless when otherwise stated, the plates are taken from photographs by Mr. R. Adam of dried specimens in the Herbarium of the Royal Botanic Garden, Edinburgh.

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XXVII. Primula cortusoides, Linn., var. lichiangensis, G. Forrest. Var. nov.

XXVIIIA. Primula congestifolia, G. Forrest. Sp. nov.

XXVIIIB. Primula malacoides, Franch. Photograph by Mr. R. Adam of a plant in the Royal Botanic Garden, Edinburgh, presented by A. K. Bulley, Esq., of Ness, Neston, Cheshire.

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XXIXB. Primula delicata, G. Forrest. Sp. nov.

XXXA. Primula vincaeflora, Franch. Plant in natural habitat. Photograph by G. Forrest.

XXXB. **Primula gratissima, G. Forrest. Sp. nov. Plant in natural habitat. Photograph by G. Forrest.**

XXXI. Primula gratissima, G. Forrest. Sp. nov.

XXXII. Primula taliensis, G. Forrest. Sp. nov.

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XXXIIIB. Primula Littoniana, G. Forrest. Sp. nov. Flower spike. Photographed in natural habitat by G. Forrest.

XXXIV. Primula coerulea, G. Forrest. Sp. nov.

XXXV. Primula Littoniana, G. Forrest. Sp. nov.

XXXVI. Primula Littoniana, G. Forrest. Sp. nov. Plant in natural habitat. Photograph by G. Forrest.

XXXVII. Primula longituba, G. Forrest. Sp. nov.

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XXXIXA. Primula Bulleyana, G. Forrest. Sp. nov. Plant in natural habitat. Photograph by G. Forrest.

XXXIXB. Primula Forrestii, Balf. fil. Sp. nov. Plant in natural habitat. Photograph by G. Forrest.

XL. Primula brevifolia, G. Forrest. Sp. nov.

XLI. Primula biserrata, G. Forrest. Sp. nov.

XLII. Primula Bulleyana, G. Forrest. Sp. nov.

XLIIIA. Androsace Bulleyana, G. Forrest. Sp. nov. Photograph by Mr. R. Adam of a plant in the Royal Botanic Garden, Edinburgh, presented by A. K. Bulley, Esq., of Ness, Neston, Cheshire.

XLIIIB. Androsace spinulifera, Franch. Plant in natural habitat. Photograph by G. Forrest.

Primula langkongensis, *G. Forrest.*

Primula cortusoides, Linn., var. lichiangensis, *G. Forrest.*

A.—Primula congestifolia, *G. Forrest.*

B.—Primula malacoides, *Franch.*

A.—Primula minutiflora, *G. Forrest.*

B.—Primula delicata, *G. Forrest.*

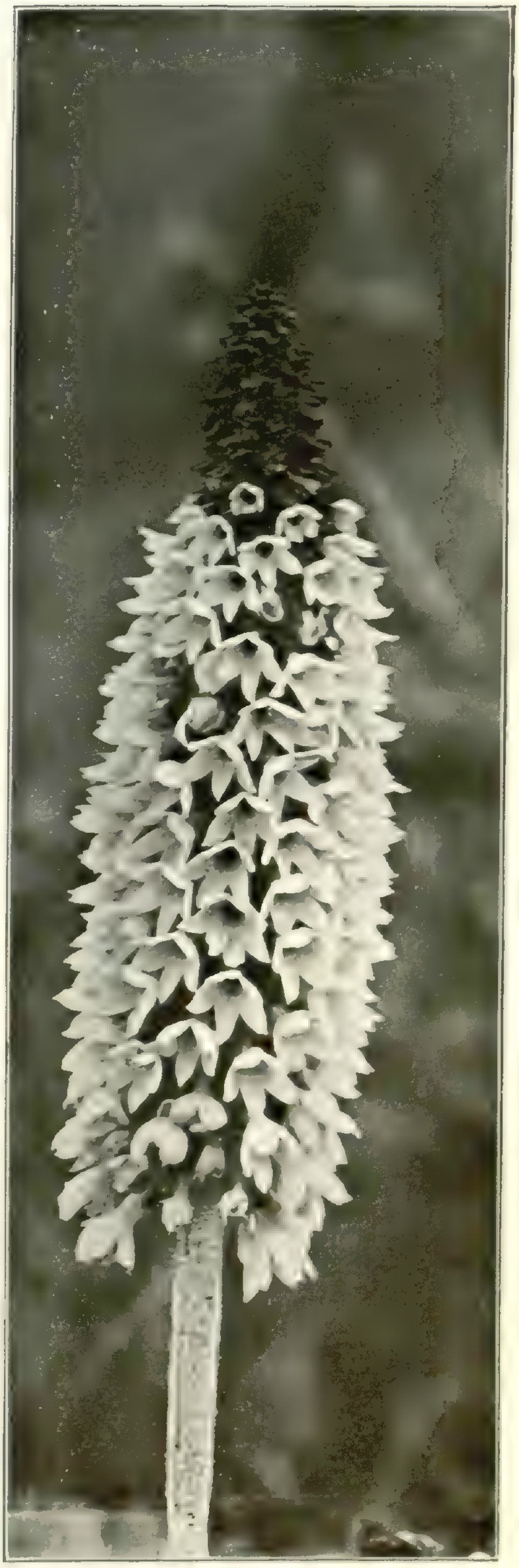
A.—Primula vincaeflora. *Franch.*

B.—Primula gratissima, *G. Forrest.*

Primula gratissima, *G. Forrest.*

Primula taliensis, *G. Forrest.*

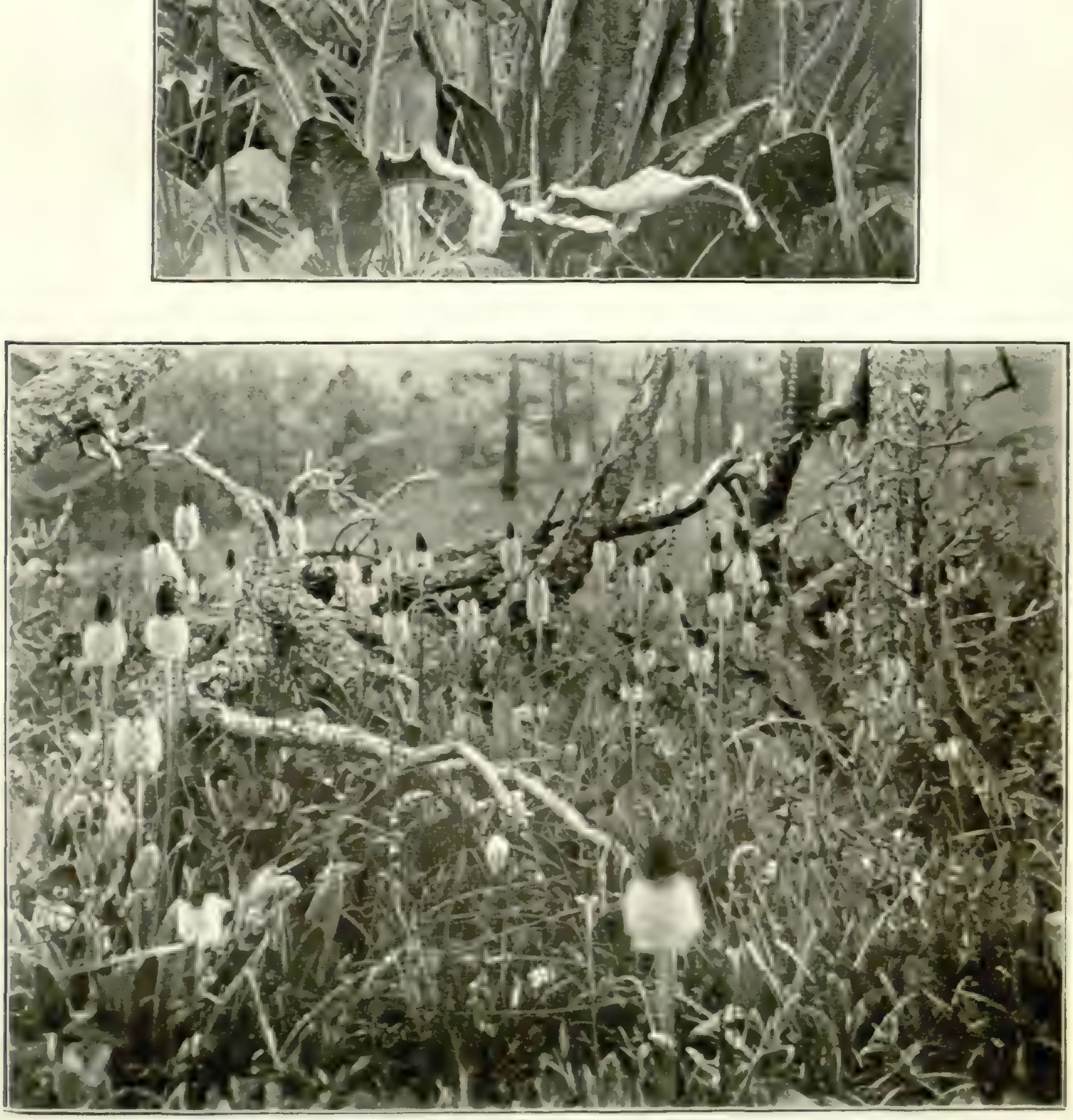
A.—Primula Dubernardiana,
G. Forrest.



B.—Primula Littoniana,
G. Forrest.

Primula coerulea, *G. Forrest.*

Primula Littoniana, *G. Forrest.*



Primula Littoniana, *G. Forrest.*

Primula longituba, *G. Forrest.*

d

Primula Forrestii, *Balf. fil.*

A.—Primula Bulleyana, *G. Forrest.*

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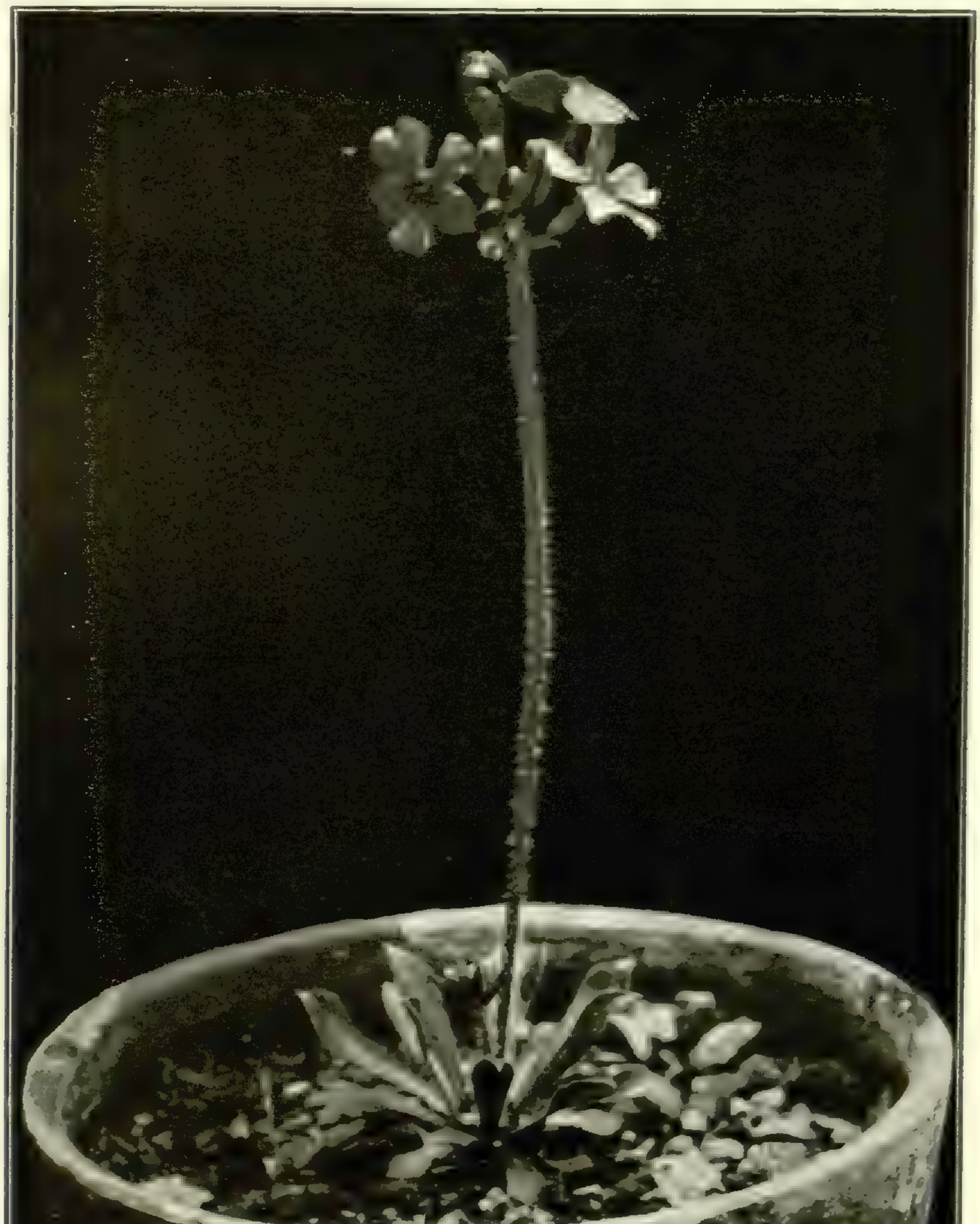
Primula brevifolia, *G. Forrest.*

Primula biserrata, *G. Forrest.*

Primula Bulleyana, *G. Forrest.*



A.—Androsace Bulleyana. *G. Forrest.*

B.—Androsace spinulifera, *Franch.*

Number XX.

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FROM THE
ROYAL BOTANIC GARDEN,
EDINBURGH.
MARCH 1909.

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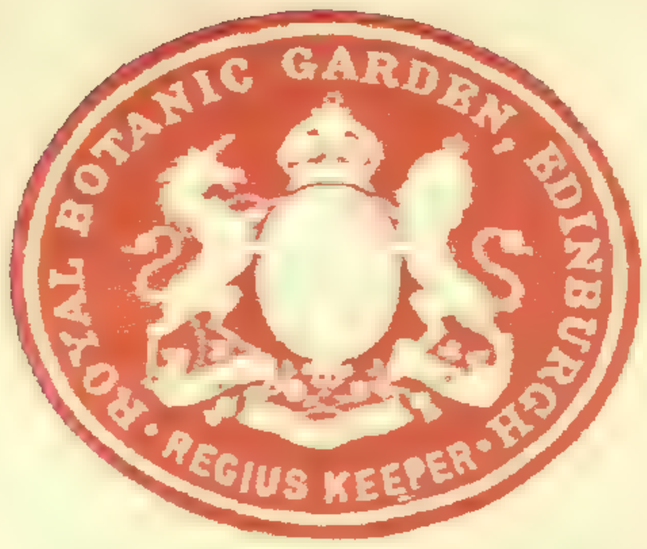

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THE ROYAL BOTANIC GARDEN,

EDINBURGH.

190

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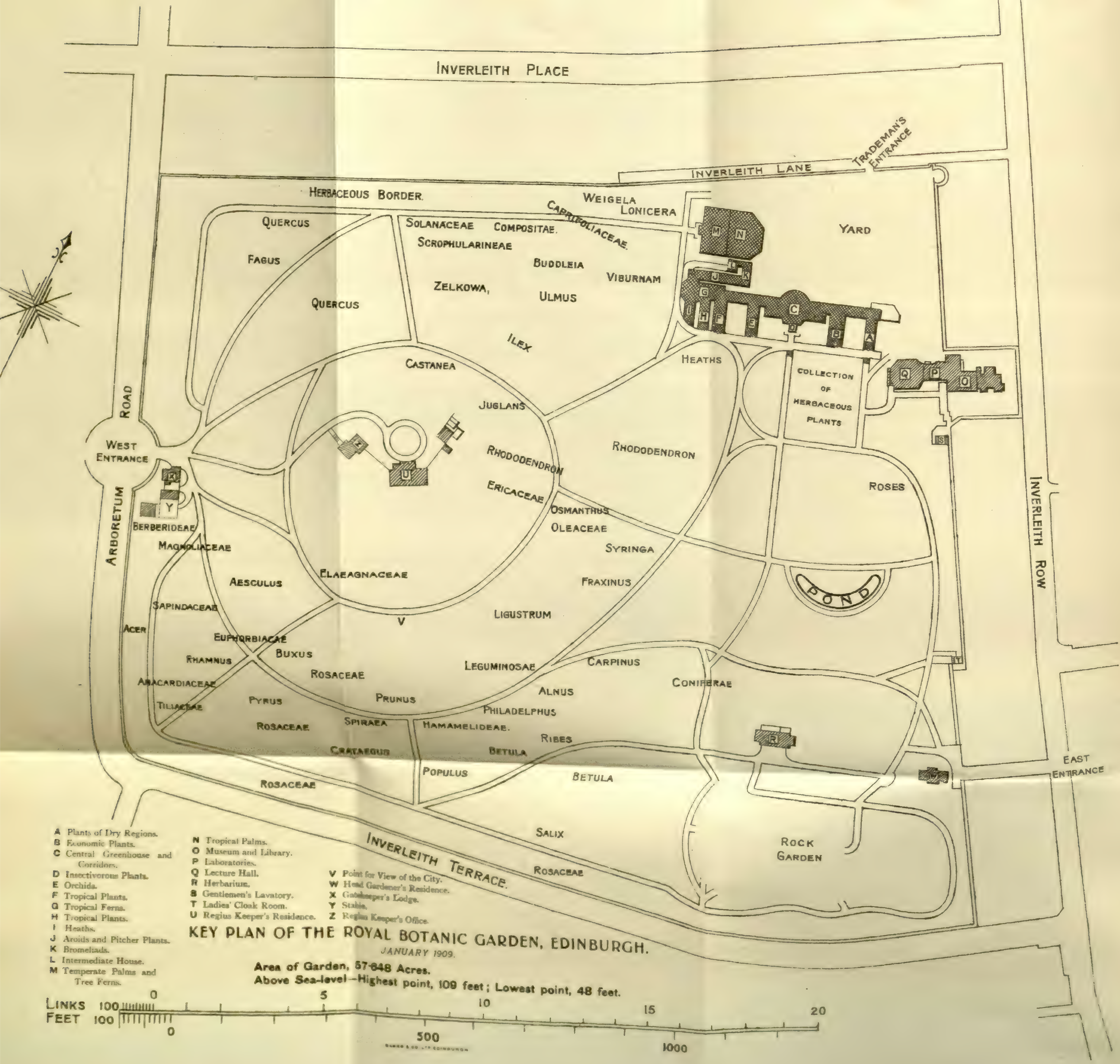

A Plants of Dry Regions.
B Economic Plants.
C Central Greenhouse and Corridors.
D Insectivorous Plants.
E Orchids.
F Tropical Plants.
G Tropical Ferns.
H Tropical Plants.
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N Tropical Palms.
O Museum and Library.
P Laboratories.
Q Lecture Hall.
R Herbarium.
S Gentlemen's Lavatory.
T Ladies' Cloak Room.
U Regius Keeper's Residence.
V Point for View of the City.
W Head Gardener's Residence.
X Gatekeeper's Lodge.
Y Stable.
Z Regius Keeper's Office.

KEY PLAN OF THE ROYAL BOTANIC GARDEN, EDINBURGH.

JANUARY 1909.

Area of Garden, 57·648 Acres.
Above Sea-level—Highest point, 109 feet; Lowest point, 48 feet.

LINKS 100 0 5 10 15 20
FEET 100 0 500 1000

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THE ROYAL BOTANIC GARDEN, EDINBURGH.

THE Royal Botanic Garden, Edinburgh, is one of the three Gardens maintained by the State in the United Kingdom, the others being the Royal Gardens at Kew in England, and the Glasnevin Garden at Dublin in Ireland. It occupies an unequally-sided quadrilateral area of 57·648 acres (bounded upon all sides by public roads and dwelling-houses) on the North side of Edinburgh—about a mile from the shore of the Firth of Forth. Its highest point, at Inverleith House—the official residence of the Regius Keeper of the Garden—towards the North-west, is 109 feet above sea-level, and thence the ground falls away on all sides. The lowest point—a depression 48 feet above sea-level, with an east and west trend through the middle of the Garden—is the site of an old bog, and the ground rises again to the south of the depression. The surface soil is generally alluvial sand resting on clay at considerable depth. In the lower part of the area the clay comes to the surface.

There are two entrances—one upon the east side from Inverleith Row into the Garden, the other upon the west side from Arboretum Road into the Arboretum.

The **Garden** is open daily from **9 a.m.** on **Week-days** and from **11 a.m.** on **Sundays** until sunset.

The **Plant-Houses** are open from **1 p.m.** until **5.30 p.m.**, or until sunset if this be earlier.

The **Museum** is open on **Week-days** from **10 a.m.** until **5 p.m.** and on **Sundays** from **1 p.m.** until sunset.

The **Herbarium** and **Library** are open on **Week-days** from **10 a.m.** until **1 p.m.**, and from **2 p.m.** until **5 p.m.**, excepting on **Saturday,** when they are open until **1 p.m.**

[**Notes, R.B.G., Edin., No. XX., March 1909.**]

1000—Wt. 38—4/1909.

Staff of the Royal Botanic Garden, Edinburgh, at March, 1908.

Regius Keeper,	Isaac Bayley Balfour, M.A., M.D., F.R.S.
Assistant in Museum,	Harry Frank Tagg, F.L.S.
Assistant in Herbarium,	John Frederick Jeffrey.
Head Gardener,	Robert Lewis Harrow.
Assistant Head Gardener,	Henry Hastings.
Foreman of Glass Department,	Laurence Stewart.
Foreman of Herbaceous Department,	Charles Dyker.
Foreman of Arboretum,	Alexander Johnston.

RULES for the Royal Botanic Garden and Arboretum in connection with the Regulations prescribed by "The Parks Regulation Act, 1872."

---

1. No unauthorised Person may ride or drive in this Garden or in the Arboretum, and no Wheelbarrow, Truck, Bath-chair, Perambulator, Cycle, or other Vehicle or Machine, is allowed to enter, except with the written permission of the Keeper. Children under ten years of age are not admitted unless accompanied by a Parent or suitable Guardian.

2. No Horses, Cattle, Sheep, or Pigs are allowed to enter.

3. No Dogs are admitted.

4. No Bags, Baskets, or Parcels, no Flowers, and no implements for games may be brought in ; Artists and Photographers may not bring in their Apparatus without written permission from the Keeper.

NOTE.—*The foregoing Rules shall not apply to persons going to or leaving Inverleith House by the road leading from the Arboretum Road Gate to the House.*

5. Visitors are to enter and leave the Plant Houses by the Doors according to the Notices affixed thereon.

6. Smoking is not allowed in the Plant Houses.

7. No Person shall touch the Plants or Flowers.

8. Pic-nics and luncheon parties are not allowed.

9. No unauthorised Person shall Drill or practise Military Evolutions or use Arms or play any Game or Music, or practise Gymnastics, or sell or let any Commodity.

10. No unauthorised Public Address may be delivered in the Garden or Arboretum. No Performance or Representation either spoken or in dumb show shall be given in any part of the Garden or Arboretum, unless by permission of the Commissioners

of His Majesty's Works and Public Buildings. No Person shall use any obscene, indecent, or blasphemous words, expressions, or gestures, or do any act calculated to provoke a breach of the Peace, in the course of, or in connexion with, any speech, address, performance, recitation, or representation. No money shall be solicited or collected in connexion with any performance, recitation, or representation, except by permission of the Commissioners of His Majesty's Works and Public Buildings.

11. Large parties must be broken up to prevent crowding.

12. Climbing the Trees, Railings, or Fences is forbidden.

13. Birds'-nesting, and taking, destroying, or injuring Birds or Animals are forbidden.

14. The distribution of Handbills, Advertisements, and other Papers by the Public is forbidden.

Dated the 28th day of April 1904.

Sealed with the Common Seal of the Commissioners of His Majesty's Works and Public Buildings.

SCHOMBERG K. M'DONNELL,
Secretary.

Seal

Historic Notice.

In the year 1670 a small portion of ground, known as St. Ann's Yards, lying to the south of Holyrood House, and usually let to market gardeners by the Hereditary Keeper of Holyrood House, was occupied by two eminent Edinburgh physicians, **Andrew Balfour** and **Robert Sibbald,** for the making of a Physic Garden, and **James Sutherland** was appointed to the "Care of the Garden." This was the foundation of the Royal Botanic Garden of Edinburgh, which is therefore, after that of Oxford (founded in 1632), the oldest in Great Britain. The Garden was stocked with plants from the private Garden of Dr Andrew Balfour, in which for some years he had been accumulating medicinal plants, and also in great measure from that at Livingston in West Lothian, the laird of which, Patrick Murray, was much interested in the growing of useful plants. Shortly thereafter, but at what precise date has not yet been ascertained, Sutherland became custodian of the Royal Garden, which lay on the north side of the Palace, and it became a Physic Garden for instruction, whilst the original plot in St. Ann's Yards was, apparently, given up.

In 1676 the same physicians acquired from the Town Council of Edinburgh a lease of the Garden of Trinity Hospital and adjacent ground for the purpose of a Physic Garden in addition to the Garden already existing at Holyrood, and they appointed the same James Sutherland (16..-1715) to be "Intendant" of this Garden. The site of this Garden, which for convenience of reference may be called the Town's Botanic Garden, was the ground lying between the base of that portion of the Calton Hill upon which the prison is built and the North Bridge, and it is now occupied by a portion of the Waverley Station of the North British Railway. The name Physic Garden attached to a street in the vicinity is a reminiscence of the existence of the Garden at this spot.

About 1702 another Botanic Garden was established in Edinburgh in the ground immediately adjacent to the College Buildings, apparently on the site of the present South College Street. This was the College Garden, and of it James Sutherland became also custodian.

Thus in the early years of the eighteenth century there were in Edinburgh three distinct Botanic or Physic Gardens—one at Holyrood, the Royal Garden ; one around Trinity Hospital, the Town's Garden ; and one beside the College, the College Garden—all under the care of James Sutherland.

Sutherland from the first made use of the Royal Garden for giving "instruction in Botany to the Lieges," and received a royal warrant appointing him Botanist to the King in Scotland, and empowering him to "set up a Profession of Botany" in this Garden. When the Town's Garden was created the Town Council appointed him to lecture on Botany as Professor in the Town's College, now the University of Edinburgh. In 1683 he published his "Hortus Medicus Edinburgensis, or a Catalogue of the Plants in the Physical Garden at Edinburgh," from which and from other published notices we learn that between two and three thousand plants were in cultivation. There are no data available from which to determine how these plants were distributed between the several Gardens at the date of publication of Sutherland's catalogue.

In 1706 Sutherland resigned the care of the Town's Garden and the College Garden as well as his Professorship in the University, but, remaining King's Botanist, he retained the care of the Royal Garden at Holyrood. Charles Preston was appointed his successor by the Town Council, and there were thus established rival Gardens and rival Professors of Botany in Edinburgh. Charles Preston died in 1712, and was succeeded in his offices by his brother George Preston. Neither of the Prestons had ever the care of the Royal Garden.

Sutherland's appointment as King's Botanist, Keeper of the Royal Garden, and Regius Professor of Botany was held during the pleasure of the Sovereign, and on the death of Queen Anne in 1714 he was not continued in office by George I.

In 1715 **William Arthur** (. . . . -1716) received a commission as successor to Sutherland, but as he was implicated in an

unsuccessful Jacobite plot to seize the Castle, he did not hold the office long.

He was succeeded in 1716 by **Charles Alston** (1683-1760).

In 1724 the College Garden, having fallen into disorder, was turned to other uses; and in 1729, George Preston having retired, the Town Council appointed, as his successor in the charge of the Town's Garden and as Professor of Botany in the University, Charles Alston, who as King's Botanist had already the charge of the Royal Garden and was Regius Professor of Botany. Through him, after separation for a quarter of a century, the Royal Garden and the Town's Garden were again combined under one Keeper, and the Regius Professorship of Botany and the University Professorship were similarly united. They have so continued to the present time.

In 1763, the Royal Garden and the Town's Garden proving too small and otherwise unsatisfactory, **John Hope** (1725-1786), who had succeeded Alston in his offices in 1761, proposed a transference of the two to a more congenial site in which they could be combined. At first it was intended to secure ground to the south of George Watson's Hospital—the area upon which much of the present Royal Infirmary is built—but this not being possible, five acres of ground to the north side of Leith Walk, below the site now occupied by Haddington Place, were chosen. As Hope proposed to transfer the collections in the Royal Garden to the new Garden he was able to secure the support of the Treasury to his scheme, and the selected ground was leased in name of the Barons of Exchequer. At the same time the Town Council agreed to contribute £25 annually to the support of the Garden, this sum being the amount of rent expected from the letting of the old Town's Garden. The plants from both Gardens were transferred to the ground at Leith Walk, and from this date there has been only one Botanic Garden in Edinburgh. The site thus secured for the Garden proved, however, only a temporary one.

Daniel Rutherford (1749-1819), who in 1786 succeeded Hope in his offices, cast about him for a spot in which more ground would be available for the extension of the Garden; and eventually in 1815 nine and a half acres of the land lying to the east of Holyrood Palace, and forming the ground of

Belleville or Clockmill, was fixed upon as a site. This selection gave rise to controversy which was prolonged, and Rutherford died before any arrangements for the transference of the Garden had been made.

Robert Graham (1786-1845), his successor, appointed in 1820, preferred the more open site of the Inverleith property which the Garden now occupies, and fourteen acres of the Field or Park of Inverleith, known as Broompark and Quacaplesink, were purchased by the Barons of Exchequer from Mr James Rocheid, its owner, in 1820, the lease of the Leith Walk Ground being sold. By 1823 all the plants had been transferred to the new Garden.

In 1858, during the Keepership of **John Hutton Balfour** (1808-1884), who succeeded Graham in 1845, a further addition, by purchase from the proprietor of Inverleith, of a narrow belt of two and a half acres was made to the Garden on the west side; and in 1865 the Caledonian Horticultural Society having resigned to the Crown its lease of the ten acres of adjoining ground which it had occupied since 1824 as an experimental Garden, this ground was also made part of the Botanic Garden. Finally the present area of the Garden was completed in 1876, when the Town Council purchased from the Fettes Trustees twenty-seven and three-quarter acres of Inverleith property on the west side of the Garden and transferred it to the Crown for the purpose of making an Arboretum in connection with the Garden; the Crown at the same time purchased Inverleith House and two and a half acres of additional ground.

In 1879, **Alexander Dickson** (1836-1887) became Queen's Botanist, Regius Keeper and Professor, and held these appointments until his death in 1887. During his term of office the Arboretum was opened to the public.

Surrounded as it now is on all sides by public roads, no further extension of the Garden upon its present site can be made.

Regius Keepers (R.K.)

from the

Foundation of the Garden.

JAMES SUTHERLAND, . .	Born 1639? R.K. 12th January, 1699?* Retired 1715. Died 24th June, 1719.
WILLIAM ARTHUR, . .	R.K. 10th May, 1715. Died 1716.
CHARLES ALSTON, . .	Born 1683. R.K. 30th June, 1716. Died 22nd November, 1760.
JOHN HOPE, ...	Born 10th May, 1725. R.K. 13th April, 1761 Died 10th November, 1786.
DANIEL RUTHERFORD, .	Born 3rd November, 1749. R.K. 20th December, 1786. Died 15th December, 1819.
ROBERT GRAHAM, . .	Born 7th December, 1786. R.K. 31st January, 1820. Died 7th August, 1845.
JOHN HUTTON BALFOUR, .	Born 15th September, 1808. R.K. 8th November, 1845. Retired 1880. Died 11th February, 1884.
ALEXANDER DICKSON, .	Born 21st February, 1836. R.K. 28th April, 1880. Died 30th December, 1887.
ISAAC BAYLEY BALFOUR, .	Born 31st March, 1853. R.K. 5th April, 1888.

* This is the date of a Royal Warrant from William III., and no earlier one has been found.

Principal Gardeners (P.G.) from the Year 1756.

(The Names of those preceding Williamson are not yet known.)

JOHN WILLIAMSON, . .	P.G. 1756? Died September, 1780.
MALCOLM M'COIG, . .	P.G. 1st January, 1782? Died 25th February, 1789.
ROBERT MENZIES, . .	P.G. 1789? Died 1799?
JOHN MACKAY, . . .	Born 25th December, 1772. P.G. February, 1800. Died 14th April, 1802.
GEORGE DON, . . .	Born October, 1764? P.G. December, 1802? Resigned 1806? Died 15th January, 1814.
THOMAS SOMMERVILLE, .	Born 1783? P.G. 1807? Died 17th March, 1810.
WILLIAM M'NAB, . . .	Born 12th August, 1780. P.G. April, 1810. Died 1st December, 1848.
JAMES M'NAB, . . .	Born 25th April, 1810. P.G. 1st January, 1849. Died 19th November, 1878.
JOHN SADLER, . . .	Born 3rd February, 1837. P.G. 13th January, 1879. Died 9th December, 1882.
ROBERT LINDSAY, . .	Born 7th May, 1846. P.G. 3rd March, 1883. Retired 31st March, 1896.
ADAM DEWAR RICHARDSON,	Born 12th September, 1857 P.G. 1st April, 1896. Resigned 31st May, 1902.
ROBERT LEWIS HARROW, .	Born 26th March, 1867. P.G. 1st June, 1902.

Features of the Garden.

The method through which the Garden was built up by successive additions resulted in an absence of combination between its several parts, in great measure a consequence of want of adequate funds to make the necessary alterations in the grounds. During the past twenty years, in which the Garden has been wholly under the administration of the Commissioners of H.M. Works, the bringing about of this combination has been in progress. The work is not yet completed, and the Plan of the Garden which is attached to this sketch shows the area of the Garden as it is laid out at this date—March, 1909. Future editions will show further changes as the work of reconstruction proceeds.

From its foundation the Botanic Garden has been devoted to the teaching of Botany, and its usefulness in this respect has determined the laying out of its area.

Herbaceous Garden.—A considerable space is occupied by a collection of herbaceous plants arranged for study in natural orders.

Rock Garden.—There is an extensive rockwork upon which alpine and rarer herbaceous plants are cultivated.

Arboretum.—The whole of the western area of the Garden is in process of arrangement as an Arboretum of trees and shrubs, and the positions of some of the chief genera are indicated on the plan. The Coniferæ are now placed in the ground adjacent to the Rock Garden.

Herbaceous Border.—Along the North Boundary of the Arboretum a mixed Herbaceous Border has been planted.

The **Plant-Houses** are still in process of reconstruction. So far as they have been rearranged at the present time they consist of a long range to the north of the herbaceous collection, composed of a Central Green-house (**C**), from the sides of which two Corridors run east and west. In the Entrance Porch (**D**) to the Central Green-house is a collection of Insectivorous Plants.

From the Eastern Corridor two houses project to the south—one (**A**) occupied by Plants of Dry Regions, the other (**B**) containing Economic Plants of both Tropical and Temperate Regions. The House terminating the Eastern end of this Corridor is one of the old and decayed plant-houses, to which visitors are not admitted pending its reconstruction. To the south side of the Western Corridor are attached two houses—one (**E**) for Orchids and one (**F**) for Plants of Tropical and Warm Regions. The western end of the Corridor opens into a domed house (**G**) for Ferns of Tropical Regions which are planted out, and attached to it are two houses running southwards, one of which (**H**) is occupied by Tropical Plants, and the other (**I**) is used as a Heath House. From the northern wing of this domed house opens a house (**J**) devoted to monocotylous Plants of Tropical and Warm Regions, specially Aroids, Scitamineæ, Liliaceæ, and Amaryllidaceæ; Pitcher Plants are also cultivated in this house. Out of this opens the house (**K**) for Bromeliads; and in another house (**L**) opening from this is a collection of plants requiring warm temperate environment. Behind the western end of the Front Range there is a Temperate House (**M**) for Palms, Tree-Ferns and Coniferæ, and a Palm-House (**N**).

Adjoining Inverleith Row is a group of buildings including the **Museum** (**O**), the **Laboratories** (**P**), and the **Lecture Hall** (**Q**).

The **Museum** contains a series of exhibits illustrating the form and life-history of plants, and these are arranged so as to facilitate their use in teaching, and attached to it is the **Library**.

Herbarium.—In the southern portion of the Garden is the Herbarium (**R**). It contains a fair representation of the Floras of the world, and the herbarium of plants belonging to the University of Edinburgh is deposited here.

The **Ladies' Cloak-Room** is at (**T**) at the side of the path leading along the eastern boundary. A **Gentlemen's Lavatory** will be found at (**S**).

From the higher ground of the Arboretum—at the point marked (**V**) on the plan—a fine panoramic view of the City of Edinburgh, flanked on the east by Arthur's Seat, and on the west by the Pentland Hills, is obtained.

Teaching in the Garden.

Special instruction in the sciences underlying the practice of Horticulture and Forestry is provided for the Staff of the Garden. The course of instruction is spread over three years, and consists of lectures upon, and practical instruction in, the sciences taught. A Reading-room and Library is also provided for members of the Staff going through the course. Young Gardeners or Foresters desiring admission to the Staff and the course of instruction should make application to the Regius Keeper.

The Regius Keeper from time to time gives lectures which are open to the Public. The Laboratories are open to anyone desirous of undertaking Botanical Research.

For more than a century and a half the offices of Regius Keeper of the Botanic Garden and Professor of Botany in the University of Edinburgh have been held by the same person, and it has become the custom that the students of the University come to the Garden for instruction in Botany.

Specimens for private study are supplied, as far as the resources of the Garden will permit, to visitors and students who make written application to the Regius Keeper. Application forms may be obtained at the office of the Garden.

Enumeration of Visitors to the Royal Botanic Garden. Edinburgh. during the Years 1889-1908.

On the 1st of April, 1889, the control of the Royal Botanic Garden, Edinburgh, was vested in the Commissioners of His Majesty's Works, and the Garden became subject to the "Act for the Regulation of the Royal Parks and Gardens, 1872." From the date specified the Garden has been opened to the public on Sundays, and also for an extended period on Week-days. The subjoined table shows the number of visitors to the Garden on Sundays and Week-days respectively during the twenty years which have elapsed since the Garden was transferred to the Commissioners of His Majesty's Works :—

Year.	Total in Year.	Total on Sundays.	Largest Number on a Sunday.	Smallest Number on a Sunday.	Total on Week Days.	Largest Number on a Week Day.	Smallest Number on a Week Day.
*1889 ...	368,219	187,457	13,935	129	180,762	3,834	50
1890 ..	446,540	216,345	11,262	91	230,195	4,032	65
1891 ..	454,083	220,543	9,445	340	233,540	3,228	76
1892 ...	437,205	218,233	13,581	149	218,972	2,666	43
1893 ...	531,232	271,893	12,860	45	259,339	3,197	40
1894 ...	526,948	268,793	13,515	68	258,155	3,153	28
1895 ...	516,608	264,497	15,227	127	252,111	5,292	26
1896 ...	516,407	296,576	13,517	527	219,831	3,825	30
1897 ...	475,210	271,730	16,001	74	203,480	3,153	20
1898 ...	443,289	258,499	12,840	123	184,790	3,234	39
1899 ...	461,686	259,424	15,161	105	202,262	2,758	30
1900 ...	561,359	324,856	17,700	268	236,503	3,667	53
1901 ...	586,461	339,229	19,256	258	247,232	4,627	45
1902 ...	522,363	295,892	15,561	165	226,471	5,461	60
1903 ...	606,184	355,310	19,583	135	250,874	4,202	41
1904 ...	639,066	367,290	20,719	374	271,776	3,564	42
1905 ...	584,546	330,995	19,859	100	253,551	2,708	60
1906 ...	699,558	394,030	21,959	84	305,528	3,760	44
1907 ...	674,208	422,899	25,601	708	251,309	3,365	40
1908 ...	585,171	342,106	20,549	570	243,065	2,898	39
Total for Twenty Years	10,636,343	5,906,597	...	...	4,729,746	...	...

* Numbers in this year for nine months only

A Botanical Physiologist of the Eighteenth Century.

BY

FRANCIS DARWIN, F.R.S.

With Plates XLIV.—XLVI.

British physiologists are justly proud of their great countryman Stephen Hales, and any evidence of the persistence of his influence on the study of Botany in this country is of interest. The true spirit of experimental inquiry, as practiced by Hales, is evident in the interesting collection of drawings made for Professor Hope[1] of Edinburgh between about 1770 and 1785, which Professor Balfour has been good enough to place in my hands.

I have also been allowed to see a manuscript volume containing John Hope's *Lectures*. They are obviously written with zest, and are clear and vigorous. He makes frequent reference to the work of Hales, Du Hamel, Mariotte, Bonnet, and others, and marshals the facts he borrows so as to form interesting discussions. But he is by no means solely dependent on the work of others; he is continually quoting his own experiments on growth in length and in thickness, on the ascent of water, on root pressure, on the much-discussed circulation of the sap (against which he argues forcibly), on the position assumed by leaves, on heliotropism, &c. The experiments are well devised and the results clearly given. The amount of his own contributions is sufficient to give an attractive atmosphere of originality to the whole.

[1] John Hope succeeded Charles Alston as King's Botanist in Scotland, Regius Keeper of the Royal Botanic Garden, Edinburgh, and Professor of Botany in 1761, and held these appointments until his death in 1786. For a time also the teaching of Materia Medica was attached to his botanical offices. An account of his life and work will appear in an early number of these "Notes," and here it need only be said that, as was the custom of his time, John Hope combined his botanical work with that of a Physician and teacher of Clinical Medicine, and consequently one might have expected that, like other botanists in his century in like positions, Botany as ancillary to Medicine and Materia Medica would have sufficed as a field of his investigations. It is therefore all the more interesting to have the evidence which Mr. Darwin has sifted here, that problems of life and response to factors of environment attracted him.—*I.B.B.*

[Notes, R.B.G., Edin., No. XX, March 1909.]

Some further reference to this valuable MS. will be made in discussing Hope's drawings—with which I am chiefly concerned.

These are some 80 in number, about half being duplicates, and are grouped according to subject in folded sheets of drying paper. In spite of their small size—the majority are about 10 x 13 inches—they seem to have been employed in lectures, because we find on them such notes as "Not used, 1785." Most of them seem to have been drawn[1] from nature in red chalk and carefully re-copied in sepia or some dark-coloured water-colour. Why they were so reproduced is not evident, since the chalk drawings are clearly superior to the copies.

Fig. 1, Plate xliv., is a good representation of the nyctitropic movements of a clover (*T. repens*). It is certainly drawn from nature, and, indeed, Hope could not, as far as I know, have found at that time any published figure of a sleeping clover leaf to copy from. Clover is not figured in Peter Bremer's dissertation on *Somnus Plantarum*,[2] where, moreover, the description of the sleep-movements, in this genus, is very imperfect.

Fig. 2, Plate xliv., is also drawn from life and is probably the earliest existing illustration of a sleeping *Desmodium*. In the figure in the *Power of Movement in Plants* the fact that the little lateral leaflets are not depressed like the terminal one is clearly shown.[3] It seems probable that Hope did not notice this; at any rate it is not made clear in his sketch.

Fig. 3, Plate xliv., is described as an *Acacia*, but as Hope notes that the upper surfaces of the leaflets meet each other it is practically certain that it represents a *Cassia*. It is difficult to understand how Hope could have made this mistake, and it is conceivable that the drawing was inscribed "Acacia" by the artist. Moreover, there is in the *Amœnitates* a good figure of a sleeping *Cassia*, from which, however, Hope's diagram is certainly not copied.[4]

The most interesting of Hope's experiments are those dealing with the combined action of light and gravity. Du Hamel[5] made

[1] The majority are signed J. Lindsay or J. L.; some are by Bell, and an occasional one is signed A.F.

[2] *Amœnitates Academicæ*, vol. iv., 1760, p. 333.

[3] P. 358; the fact that the small leaflets are awake, at any rate during the early part of the night, is given at p. 362.

[4] The *Cassia* figured (p. 371) in the *Power of Movement* is possibly the same species as that in the *Amœnitates*.

[5] *Physique des Arbres*, 1758, vol. ii, p. 148.

an inconclusive experiment bearing on this point. He says that seedlings, over which a horizontal plate of an opaque material is suspended, do not grow straight upwards, but curve outwards from the centre. He notes that, if the plate is made of glass, the seedlings grow vertically up until they nearly touch it. But it is not clear that he recognised a heliotropic effect, since he seems to have expected to get different results by employing copper, porcelain, and cardboard as his opaque material. Hope made this experiment (*MS. Lectures*, p. 94) and illustrates his method in Fig. 12 on the plate following p. 102. He clearly understood that the outward curvature of plants shaded by a piece of board is an effect of light, for he gives other experiments to settle the question whether such movements are "to get at the light or the air," and decides in favour of light.

Another set of excellent experiments directed to the same point are illustrated in his diagrams.

Fig. 4, Plate xlv., shows *Asperula odorata* curving upwards "in the open air," *i.e.*, probably when lighted from above.

In Fig. 5, Plate xlv., the same plant shows apogeotropism when but faintly lighted from below.[1]

Fig. 6, Plate xlvi., shows that when the plant is well illuminated from below by means of a mirror, the geotropic curve is straightened out by the stimulus of light.

Fig. 7, Plate xlvi., shows another method for demonstrating the victory of heliotropism.

These experiments were made in June 1780, but the facts were not known to physiologists until nearly 100 years later, when H. Müller Thurgau[2] and Elfving[3] published them. It is true that in 1833 Schultz Schultzenstein[4] says that "seeds of *Brassica oleracea*, *Sinapis alba*, and *Phaseolus vulgaris* placed in moss and arranged so that they receive the sun's rays by means

[1] It is not certain that the curve shown in Fig. 5 was produced under these conditions. Probably it is meant to show that the curvature obtained in Fig. 4 remains under the conditions of Fig. 5.

[2] *Flora*, 1876, p. 94.

[3] *Acta Soc. Sc. Fennicæ*, T. xii, 1883, p. 25: Elfving's paper is, however, dated 1880. The experiment is included in F. Darwin and Acton, Practical Physiology, ed. iii, p. 182.

[4] See "Rapport sur le grand prix de physique" in the *Archives de Botanique* ii., p. 431. The author's name is here given as Schultz, but from the nature of the *Rapport* it is clear that he is the Schultz Schultzenstein celebrated for his unconvincing work on latex.

of a mirror, from below, and not otherwise, direct their stems towards the earth and their radicles towards the sky." But this discovery seems to have been generally overlooked, though it is mentioned in Treviranus' *Physiologie.*

Among the remaining diagrams, the most interesting are those which give the result of Hope's investigation of the distribution of longitudinal growth in stems. In this he was probably following Hales,[1] who marked both leaves and stems at regular intervals, which being remeasured gave the desired result. As far as stems are concerned Hales' method is not nearly so good as that of Hope. Hales marked a vine shoot in the spring and only remeasured it in September. Hope marked the young shoots of trees and of a hop and measured the increase of each zone at intervals of either one or two days. If he had persevered he would certainly have made out the laws of the distribution of growth which we owe to Sachs. But he seems to have been careless in measuring the marked zones, and though he notes as remarkable that the quickest growth was not necessarily in the zone nearest the apex, there is no evidence that he had mastered the problem: his observations and the diagrams in which they are embodied are hardly worth reproducing. In his *MS. Lectures* (p. 50) he draws the interesting conclusion "that stems do not elongate exactly as roots do (according to Mr. Du Hamel), but that they elongate not only at the extremity but even in the part near it." This generalisation is an approximation to Sachs' teaching on the subject.

Hope also made experiments on the "descent of sap" by the well-known methods of "ringing" and of compression by means of ligatures. His diagrams are records of actual experiments, but they are hardly worth giving, since both Hales and Du Hamel had previously published drawings illustrating this method of inquiry. Nor does it seem necessary to reproduce Hope's records of the healing of injured tree-trunks, though they are not without a certain interest.

[1] Vegetable Staticks, 1727, p. 330.

Fig. 1. Fig. 2. Fig. 3.

Professor Hope's Diagrams.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Professor Hope's Diagrams.

Notes, R.B.G., Edin.

Aerial Roots of Tibouchina Moricandiana, Baill.

BY

BERTHA CHANDLER, M.A., B.Sc.,

CARNEGIE RESEARCH SCHOLAR IN BOTANY.

With Plate XLVII.

At the Royal Botanic Garden, Edinburgh, a specimen of *Tibouchina Moricandiana* in one of the plant-houses, under conditions of excessive heat and moisture, showed abundant aerial roots. As these roots were somewhat abnormal in appearance, especially with regard to their branching, I have examined them and give here the results, which are of some interest, of my investigation so far as it has been possible to carry it up till now.

The roots arise on the upper branches of the plant, usually from a node, though this is not always the case (see Figs. 1 and 2). In general appearance they are 10 cm. to 15 cm. in length, brownish green in colour, stiff, distinctly transversely wrinkled, and variously branched (Figs. 3 to 9). Usually they show negative geotropism, hanging from the under side of the branches; occasionally they are para-geotropic.

As the roots age, they become constricted at their base, and gradually wither off from the portion nearest the base towards the tip until the whole is withered. This points to a short life and no great functional activity.

To test their capacity it seemed worth while to study their development under soil. Some were therefore cut off from the tree and placed in fibre in a forcing-house. They grew considerably in length, which fact was distinctly noticeable on account of the white colour, but they did not branch.

A shoot was then cut off with aerial roots already developed on it, and was placed so that the roots were plunged in fibre in

[Notes, R.B.G., Edin., No. XX, March 1909.]

a forcing frame. After a short time, the aerial roots developed as ordinary roots, giving off lateral rootlets, and becoming quite white. In this respect, the roots examined differed in no way in their development from ordinary aerial roots which reach the soil.

The structure of the unbranched portion of the aerial root is normal. The pith is large, a considerable quantity of wood tissue is present, the whole vascular area forming a normal complete ring (Fig. 11). A section of an older portion of the root, as compared with the young one, shows a somewhat smaller pith, more wood tissue, and a very marked cork cambium, with a large development of cork (Fig. 12).

It is noteworthy that in the sections of the older portion the cork cambium consists of a layer of cells rounded, but lengthened in a transverse direction, with two layers of clear cells on either side, more squarish in outline (Fig. 12 *cc.*).

The most interesting feature of these aerial roots is their terminal arrest in growth, and the consequent branching that takes place. The root tip appears to die off after the roots have attained a short length, and the tissues around the apex continuing development, cause a swelling encircling the dead tip after the fashion of a callus cushion (Figs. 3 and 7), and the whole end of the root has a club-like shape with a depression at the end a mm. or more in depth, at the bottom of which is the dead growing point of the root. From the tissues forming the margin of this depression there may sprout a circlet of branch rootlets (Figs. 3 and 7). In other cases the death of the tip of the primary root is followed by what is really a fission of the root. The tissues around the dead tip do not develop symmetrically to form a circular cushion, but on two sides of a median plane, and thus two usually flattened out-growths, equal or unequal in size, develop with the rooted root tip between them at their point of separation (Figs. 6, 10). Or again, from the point where the dead tip was, the whole root may become flattened—opened out, as it were—as a fasciated structure divided at its end into lobes of varying number (Figs. 4, 8).

We have two distinct things to look at here :—

1. The lobes, as I have called them, which arise by the splitting of the end of the original mother root, as is illustrated by Figs. 4, 6, 8, 10.

2. The branch rootlets which arise, as is shown in Figs. 3 and 7, as lateral out-growths from the club-shaped extremity of the root.

Both phenomena are a consequence of the death of the tip of the mother root, which brings about an area of dead tissue in the centre of the end of the root. Around this dead tissue an inner cambium is formed in the pith (Fig. 13 *ic.*), and as the root tissues continue growth to form the swollen end of the root, this inner cambium keeps pace in the formation of tissue as a lining to the central cavity thus produced in the root (Fig. 14 *ic.*). The ultimate destiny of this inner cambium is the point to which I have now to direct special attention.

It will simplify description if we base this upon the case where the mother root splits into two flattened lobes. An examination of one of these lobes when completely formed shows a structure such as is represented in Fig. 21. That is to say, there is similar construction to that of the mother root, save that the whole organ, instead of being cylindric (Figs. 11, 12), is compressed and bilateral. There is a pith, a vascular ring with wood cambium, a cortex, and cork cambium. We have therefore in the case in point two root-organs with complete though compressed root structure, which have arisen by the splitting of one complete cylindric one. How does this come about?

Briefly—the inner cambium (Figs. 13, 14 *ic*) is the tissue through which the half vascular system in each of the lobes formed by the splitting of the mother root is completed as a ring. Reference to Fig. 10 will make clear the process, and transition stages are shown in Figs. 18, 19, 20.

When the tip of the cylindric mother root dies and the root splits, each half has necessarily on its outer convex side half of the cortex of the mother root covering a half of the vascular cylinder, within which lies a part of the pith with a layer of inner cambium and a portion of the cells that have so far been formed by it. Each half-root is then dorsiventral. The inner cambium now develops tissue rapidly to complete the vascular cylinder, and it is clear that in order to do this the cambial cells formed on the originally inner side of this inner cambium will be phlœm elements, those on the originally outer side will be xlyem elements. From this inner cambium the cortex required to complete that of the half-root is also derived, and in it the subsequent cork cambium arises.

We have here, then, an interesting illustration of a pith cambium ultimately becoming continuous with a wood cambium, and developing with it phlœm and xylem tissues in normal sequence, although in order to do so the relative position of these to the pith cambium in its primary position in the root has to be inverted.

What causes the death of the root tip I cannot say. The cells in the centre of the root appear as if injured, and the presence of fungus mycelium has been detected in them. But the material available so far for investigation does not enable me to express an opinion as to whether this mycelium is to be regarded as a stimulating cause in the production of the phenomenon.

Where the lobing at the end of the root has a fasciated character, the method of development is in essential the same as that I have described. The mother root simply opens out unsymmetrically, splitting at the same time along one side, and an obliquely-mouthed depression appears at the base of the fasciated lobes.

In the cases where the circular cushion swelling is formed surrounding the mouth or an apical depression (Figs. 3, 8), the construction of the cushion is on the same lines as that of the transition stage shown in Fig. 18. The trumpet-shaped depression is really the symmetrically opened out root end, lined by an inner cambium producing cells which become cuticularised on the free surface and collapse, and through which mycelium ramifies. In this formation the mother root does not break up into lobes, but there is a formation of branch rootlets in a circlet, as has been already described. I am not yet able to speak with certainty about the origin and development of these rootlets, owing to the failure of material, but there are indications in the structure of the roots I have examined suggesting points of interest for investigation when material serves.

There is nothing to notice particularly in the origin of the aerial roots upon the stem. They come off from the pericycle and pass out in normal fashion (see Fig. 17). But the branch rootlets from the swollen end of the arrested aerial roots offer a problem for solution. In Figs. 14 and 16, at *r* there may be seen in the cortex outside the epidermis small groups of cells which one might take to be the initials of those lateral rootlets. If the suggestion be confirmed we must regard this cortical mass as a callus meristem formed in correlation with the death of the root

tip. The decision upon this point must, however, be held over for determination hereafter, as also must be the meaning of certain curious thick-walled cells that are visible in the cortex.

My thanks are due to Professor Bayley Balfour, under whose direction this investigation has been carried out; also to Dr. A. W. Borthwick for many valuable suggestions.

EXPLANATION OF THE FIGURES IN PLATE XLVII.

Illustrating Miss Chandler's Paper on "Aerial Roots in Tibouchina Moricandiana, Baill."

FIG. 1. Aerial roots, *r*, on growing plant.

FIG. 2. Ditto.

FIG. 3. Aerial root swollen at the end and with circlet of branch rootlets.

FIG. 4. Aerial root swollen at the end and with two unequal lobes.

FIG. 5. Aerial root swollen at the end and with one normal branch behind the extremity.

FIG. 6. Aerial root ending in two lobes formed by fusion.

FIG. 7. Aerial root like that in Fig. 3.

FIG. 8. Aerial root spread out in a fasciated manner and ending in three lobes.

FIG. 9. Aerial root, undivided, showing transverse wrinkling.

FIG. 10. Diagrams illustrating arrest and fusion of the aerial root.

A. The primary aerial root, *P*, with pith and vascular system, has been arrested in growth and its tip has died off, whilst the portion behind the tip has grown out as two diverging lobes, S_1 S_2, each with a pith and surrounding vascular system. The cavity formed by the dying out of the root tip and tissue adjacent to it is bounded by an inner cambium (shaded in the figure), from which is formed a portion of the vascular system, V_2 V_2, of each of the divergent lobes, the other portion of their vascular systems, V_1 V_1, being the direct continuation in each case of half of the vascular system of the primary root.

B. Illustrates the same general features as A, but here the end of the primary aerial root dilates to form a wider cavity, and from the edges of this trumpet-like expansion branch rootlets, *r*, arises.

FIG. 11. Aerial root in transverse section, showing normal structure.

FIG. 12. The same at the older stage.

FIG. 13. Aerial root in transverse section, level of A in Fig. 10A, showing beginning of hollowing out of central tissue of roots after death of the tip. Inner cambium, *ic*, beginning to form.

FIG. 14. The same at level E in Fig. 10B. The inner cambium, *ic*, well formed. Cuticularised and collapsing cells formed from inner cambium lining the cavity in root. *r*, possible initials of branch rootlets.

FIG. 15. Further stage of the same. *ic*, inner cambium.

FIG. 16. Portion of 14 more highly magnified, showing possible initials of branch rootlets at *r*, *r*, *r*.

FIG. 17. Normal origination of a rootlet from pericycle.

FIG. 18. Lobe of a split root showing dorsiventral structure. *ic*, inner cambium which afterwards complete the vascular system ring.

FIG. 19. A later stage of features seen in Fig. 18.

FIG. 20. Still later stage than 19.

FIG. 21. Completed lobe resulting from splitting of root. The vascular rings show no difference on the two sides, yet the one side is derived from the vascular ring of the primary aerial root. The other is formed from the inner cambium.

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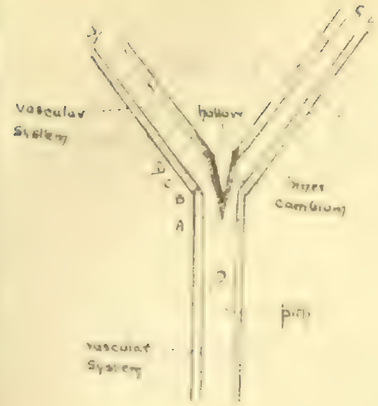

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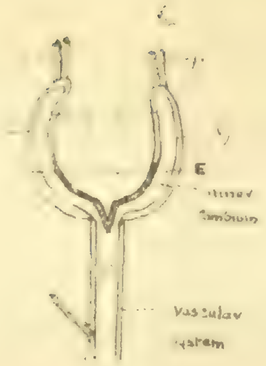

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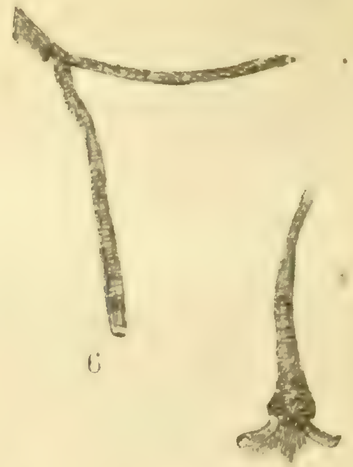

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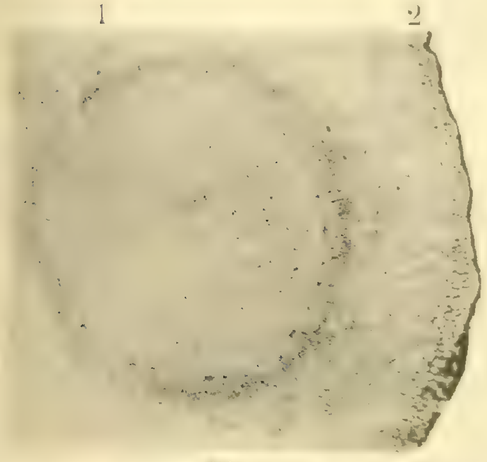

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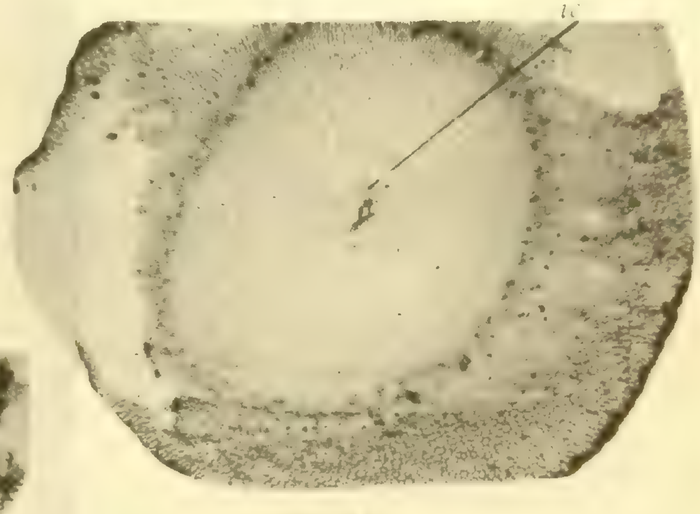

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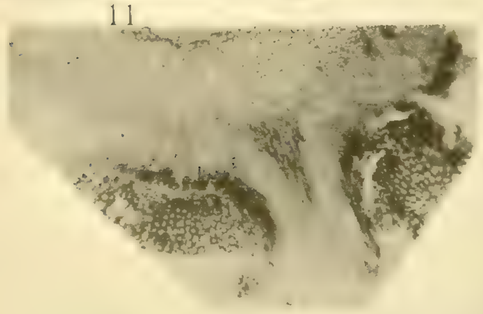

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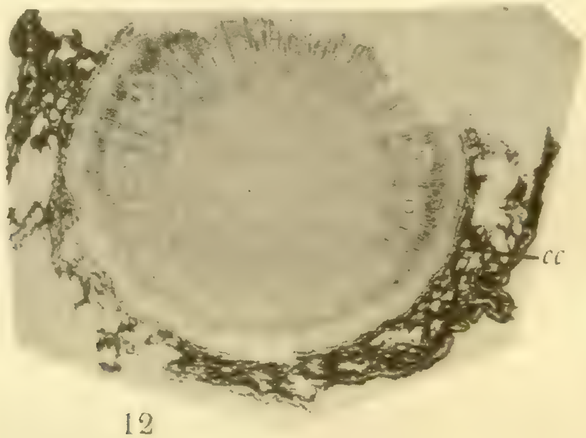

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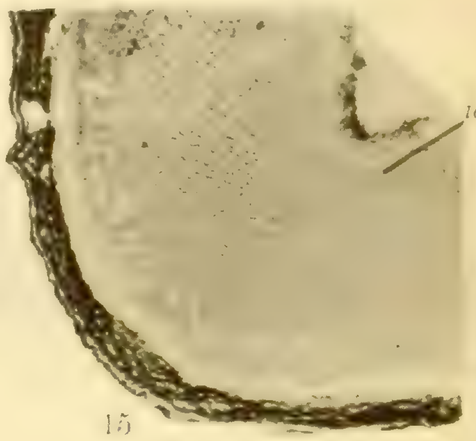

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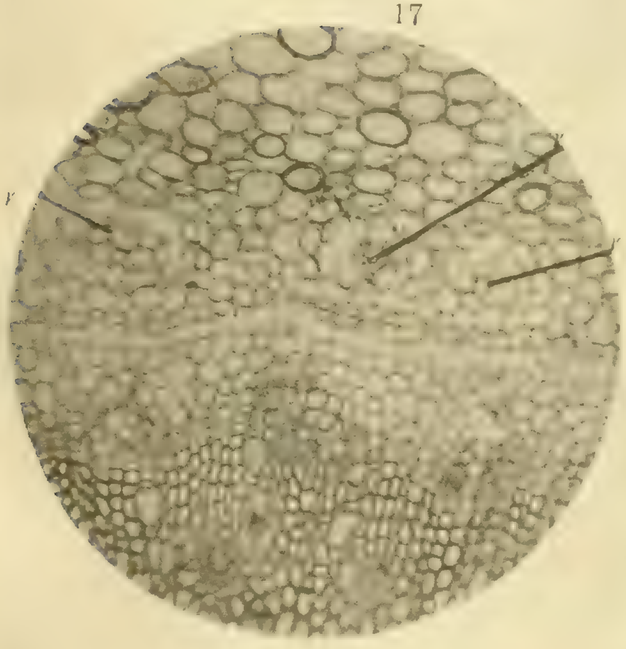

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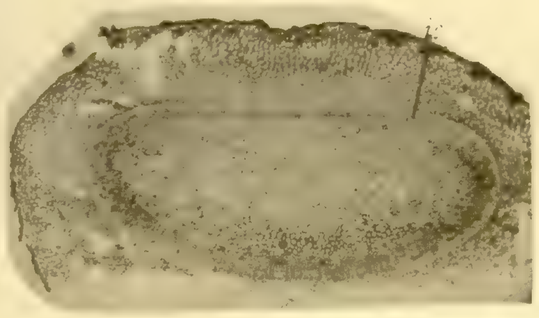

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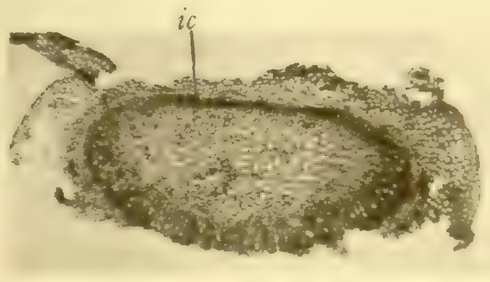

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21

CHANDLER—AERIAL ROOTS OF TIBOUCHINA.

Note on Abnormal Sporocarp of Salvinia natans.

BY

ALFRED J. GRAY, M.A., B.Sc.

With Plate XLVIII.

This sporocarp, remarkable in that it contains both mega- and microsporangia, was found among material supplied at the Royal Botanic Garden, Edinburgh, to the class of Advanced Practical Botany.

Normally the Hydropterideæ, which are heterosporous, have their microsporangia and megasporangia in different sporocarps, which in *Salvinia* are externally indistinguishable, but in *Azolla* are quite distinct. Yet in *Azolla* the two kinds of sporocarps can be traced back to one type, whilst in the case of *Salvinia* there has been an almost entire lack of evidence of common origin.

In the microsori of *Azolla*, the megasporangium aborts at an early stage. In the megasori, on the other hand, only the mega-sporangium develops, but there are found at later stages of development primordia of microsporangia, which abort. *Azolla* thus shows what we may take to be the stage of separation of the original hemaphrodite sori into male and female ones.

In the male sorus of *Salvinia*, on the contrary, we do not find aborted microsporangia, nor aborted megasporangia in the female sorus. But in my specimen we have an example of the primitive stage which is more closely approached by *Azolla*, and the value of the evidence is strengthened by the close relationship between the two. It is easy to understand the cause of the development, for, as Goebel[1] points out, the separation of microsporangia and megasporangia favours cross-fertilisation.

So far as I am aware, this particular abnormality has been only once before observed. It is recorded by Goebel[2] :—"We

[1] Goebel, Organography of Plants, vol. ii. (1905), p. 487. footnote 6.

[2] Goebel, *l.c.*

[Notes, R.B.G., Edin., No. XX, March 1909.]

have no reason for supposing that Salvinia originally had sori composed of both microsporangia and megasporangia, yet the behaviour of Azolla suggests such a supposition." . . . . "Moreover, Heinricher found on one occasion in Salvinia natans a sporocarp which contained some megasporangia among a number of microsporangia."

There may have been some peculiarity in the material supplied, as this feature seemed less rare in it than in that examined by those who have investigated these plants. I had two other examples of it among the sporocarps I examined, and of these I am positively certain that one at least was a case similar to that shown. I may mention that no normal female sporocarps have been found in this material to my knowledge. But this is negative evidence, and some may yet be found. If we take it that the material is quite normal, the repetition of instances is an important support to the supposition that this is merely a reversion to a more primitive state of hermaphroditism—once the ordinary condition in the Hydropterideæ.

My thanks are due to Mr. W. E. Evans, who was kind to make the excellent photographs reproduced on Plate xlviii.

EXPLANATION OF THE FIGURES IN PLATE XLVIII.

Illustrating Mr. Gray's Note on "Sporocarp of Salvinia."

FIG. A. Normal sporocarp.
FIG. B. Abnormal sporocarp.

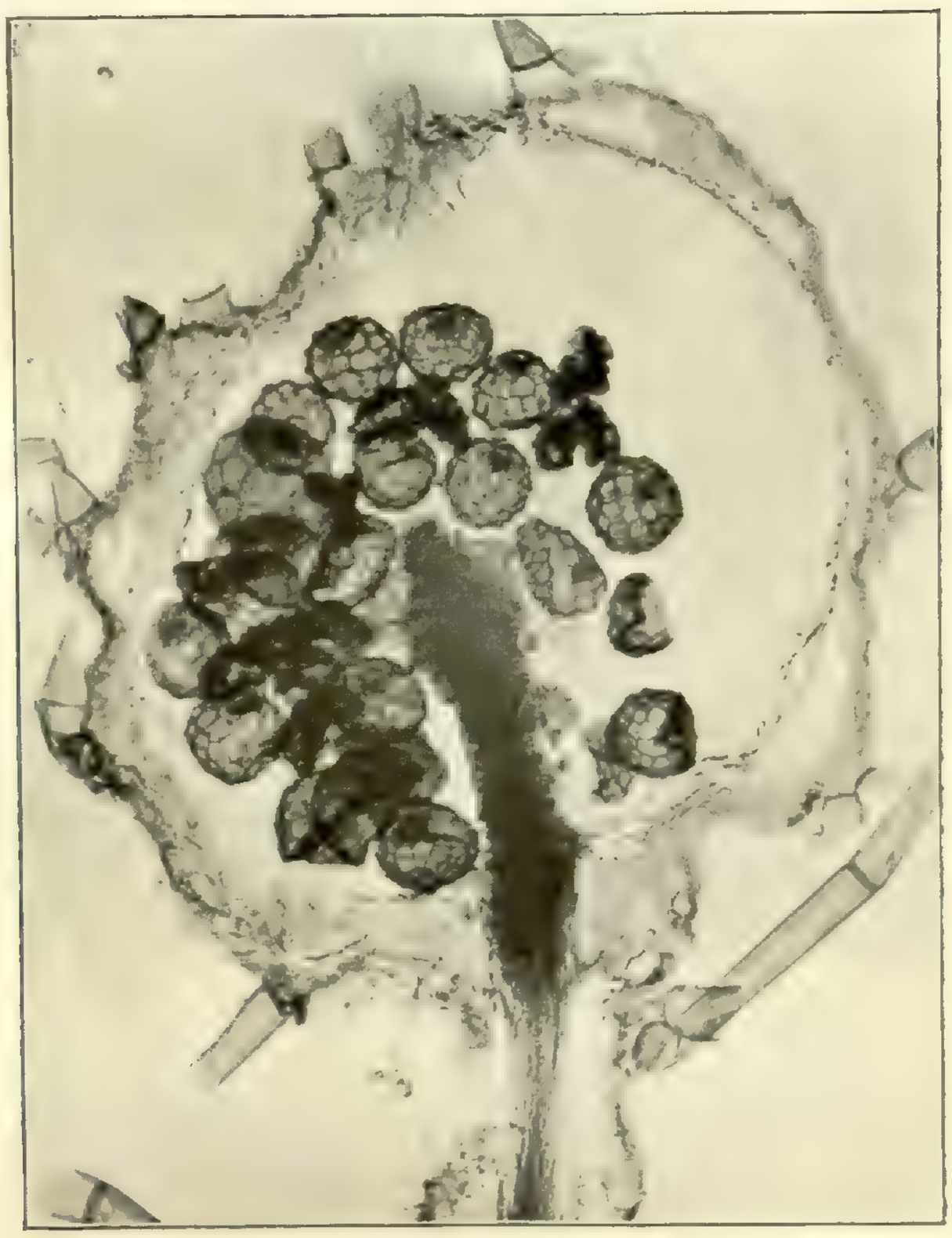


Fig. A.

Fig. B.

Gray—Sporocarps of Salvinia.

Abnormal Prothalli of Pinus sylvestris.

BY

MARY BARTHOLOMEW.

With Plate XLIX.

When studying the life history of *Pinus sylvestris* recently in the Laboratory of the Royal Botanic Garden, I found in a hand-made section of an ovule the structure shown in Plate xlix., Fig. A. It resembles in its features that of an ovule described and figured some years ago by Professor Bretland Farmer,[1] but my specimen shows certain differences, and in any case the occurrence of anomalies of the kind have been recorded so seldom that a notice of this one may not be superfluous.

The prominent feature in the specimen is the occurrence of a pair of archegonia, Fig. A,a_1, not quite at the same level at the chalazal end of the embryosac, and of a single one, a_2, at the micropylar end. But closer examination shows that the prothallar body in which they occur is not normal. In Fig. A, there is visible at s_1 a distinct lobing of the mass, and passing downwards in the figure, *i.e.*, towards the micropylar end from this indentation, there is an evident line of demarcation between a micropylar and a chalazal portion of the prothallar body. At s_1 the separation of the two is so definite that there is a space between them, but elsewhere in the section, at s_2, for example, there is no break in continuity between the tissues of the prothallar masses, although there is a difference in the size of the cells at their point of junction as compared with those in the rest of the mass.

We may assume, it seems to me, that there are here two pro-

[1] Farmer, on the occurrence of two Prothallia in the Embryosac of Pinus, Ann. of Bot. VI (1892).

thalli which are partially fused, their archegonial ends being free and turned in opposite directions. In Professor Farmer's specimen, to which I have referred, there were two prothalli apparently more sharply separated than in the one I describe, but the archegonial end of each was directed towards the micropyle, and the prothalli lay therefore somewhat side by side, one, however, overlapping the other. In this feature Professor Farmer's specimen differed from my one, where the prothalli are antiposed.

The explanation of the abnormality which naturally occurs to one is that two of the four potential megaspores of the sporocyte, instead of one as is usual, have germinated and formed each a prothallus; but the solitary specimen I have for examination furnishes no material for a critical opinion.

I may, however, add this. It is evident that an embryo formed from an egg of one of the chalazal archegonia in my specimen would have its cotyledons forced towards the micropyle in germination, whilst the apex of the radicle would in vain push against the hard shell around the chalaza. May it be, then, that it is through an anomalous prothallial development of this kind that those occasional abortive attempts at germination of the seed are to be explained, in which the cotyledons emerge first of all through the micropyle, the radicle does not issue, and the whole seedling, therefore, dies soon through want of an absorbing primary root?

Since the above was written, a series of ovules have been cut by the microtome in the Botanical Laboratory for the purposes of a demonstration series from the excellent material collected at Crookston, on the borders of Midlothian and Berwickshire, from which my specimen was obtained, and one of these ovules shows conspicuously the features of multiplication of prothalli; so much so, that I have included, by permission, an illustration of it (Fig. B in Plate xlix.) side by side with the figure of my own specimen. The section figured shows an arrangement of prothalli more resembling that in Professor Farmer's specimen. At s_1 there is evident separation of the archegonial ends of two prothalli, at s_2 the line of separation is still evident, and at s_3 there is the limit of the prothallus which approaches nearer the micropyle, and in which two archegonia, a^1, are visible. At a_2 is the only archegonium visible in the other prothallus, but in other sections of the ovule more archegonia are visible. That in this ovule a third

prothallus is represented might be suggested. Above the archegonium at a_2 there is indication of a line of separation which would pass below the body marked a_3, which may be an archegonium also, and if so it is altogether out of place as a product of the prothallus bearing a_2. Upon this and other points I do not dwell further at present. An examination of more material will enable me, I hope, to say more on another occasion.

EXPLANATION OF THE FIGURES IN PLATE XLIX.

Illustrating Miss Bartholomew's Paper on "Abnormal Prothalli of Pinus sylvestris."

FIG. A. Ovule in longitudinal section. a_1 a_2, archegonia. s_1 s_2, line of separation of prothalli.

FIG. B. Ovule in longitudinal section. a_1 a_2, archegonia. a_3, probably another archegonia. s_1 s_2 s_3, lines of separation of prothalli.

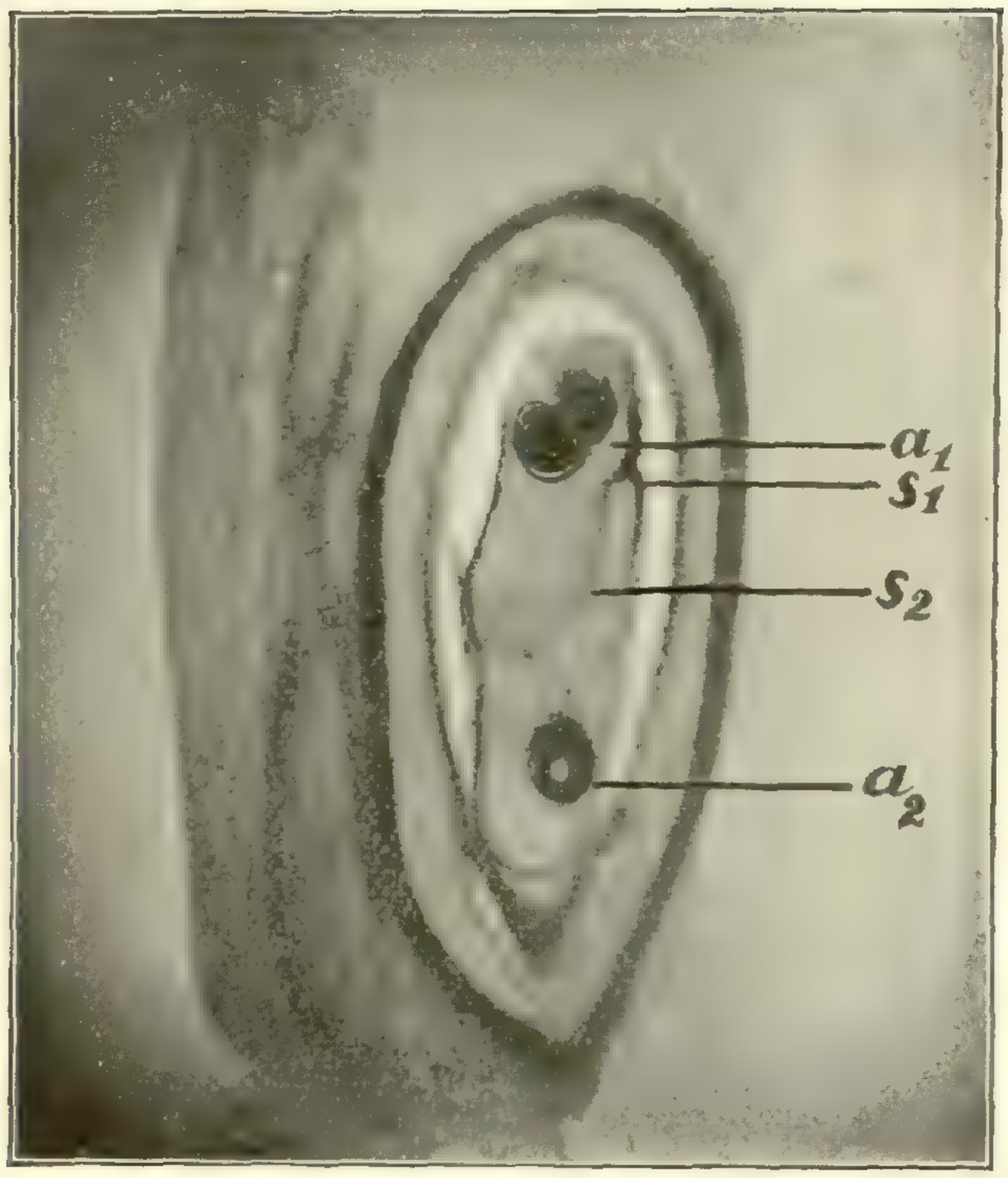


Fig. A.

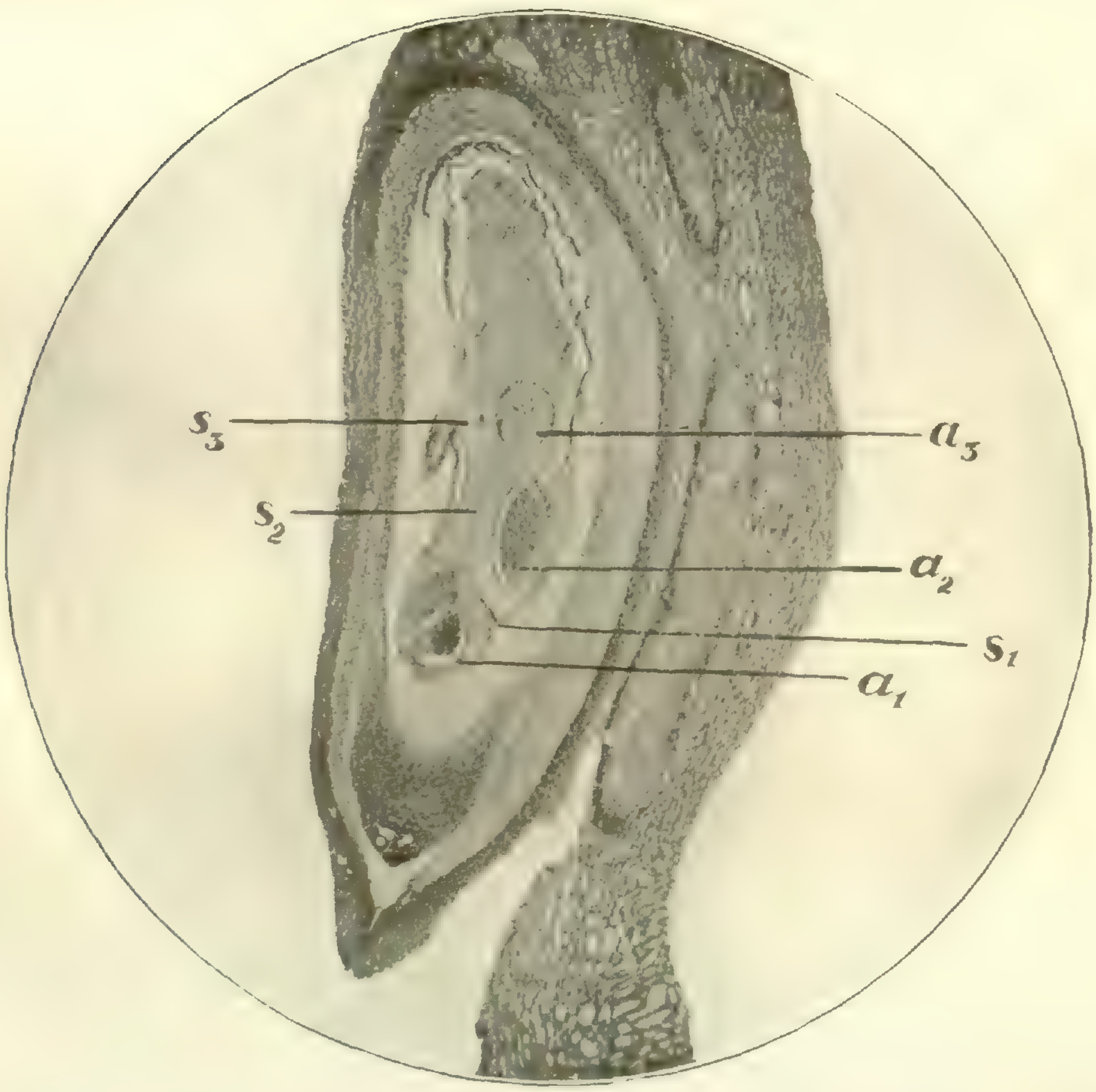


Fig. B.

Bartholomew.—Abnormal prothalli in Pinus sylvestris.

Preliminary Report on Specimens of Silicified Wood collected by John Muir, Esq., at Adamana, near Holbrook, Arizona, U.S.A.

BY

W. T. GORDON, M.A., B.Sc.,

Falconer Fellow, Edinburgh University.

Twelve specimens[1] of fossil wood were sent for examination, and of these, three were not sufficiently well preserved for identification. Two of these three had patches of the tissue preserved, but the third specimen had no structure. The remaining nine were all specimens of *Araucarioxylon*, and one of them is a new species; on this last, more research is necessary before a complete description can be given. An interesting point brought out by this collection is that the darkest and dullest specimens shew more perfect preservation of the tissues than the clearer and brighter ones. It is to be hoped that Mr. Muir may be able to obtain further examples of wood from this locality, and that cones belonging to these trees may also be discovered. The following is a list (with short descriptions) of the specimens:—

No. 1. Stem with tissue preserved only in patches.

No. 2. Thin fragment of wood near the outside of the trunk. The branch bundles have a quincuncial arrangement. The cells have bordered pits on their radial walls, and the medullary rays are from 2 to 10 cells high.

No. 3. A new species of *Araucarioxylon* with broad medullary plates separating the xylem plates. Small normal medullary rays traverse the xylem plates. The cells of the medullary plates are elongated transversely, and

[1] The Royal Botanic Garden is indebted to Mr. David Douglas, 10 Castle Street, for these specimens which were received in 1907.—*I.B.B.*

the leaf-traces pass through them. In transverse sections of the stem these plates have a "herring-bone" structure. The xylem shows bordered pits (sometimes in more than one series) on the radial walls of each tracheide. The preservation is very good.

No. 4. In this specimen the pith is preserved and consists of large thin-walled parenchyma, but here and there are dark-stained elements which probably were resin canals. The protoxylem elements are ranged round the periphery of the pith. The xylem has bordered pits on the radial walls, but they are rather indefinite, as also are the medullary rays.

No. 5. The pith is small, with peripheral protoxylems. The leaf-traces arise from the protoxylems, and fork in the wood, passing out in pairs. They are arranged in pairs in a quincuncial series on the outside. The alternation of active growth and resting periods seems to have varied, and so the zones of small xylem elements vary in thickness. The xylem elements have bordered pits in a single series on their radial walls; the medullary rays are only represented by dark lines.

No. 6. Similar to No. 5, but of greater diameter.

No. 7. No tissue preserved.

No. 8. A wedge of wood some distance from the central pith. The branch-traces are single and quincuncially arranged. Individual cells of the medullary rays are indistinct, but the rays are quite obvious and from 2 to 12 cells high.

No. 9. This is the best-preserved specimen. The xylem consists of cells with one row of bordered pits on their radial walls only. The medullary rays are well preserved, each cell being shewn, and the ray is from 4 to 12 cells high.

No. 10. This stem shows no internal structure.

No. 11. The specimen is slightly crushed, and so the cells are irregular in shape. Nothing definite of the minute cell structure can be discerned.

No. 12. In this stem the cells are much crushed, and the minute structure is indeterminable.

A New Disease of Picea.

BY

A. W. BORTHWICK, D.Sc.,

LECTURER ON FOREST BOTANY, UNIVERSITY OF EDINBURGH.

With Plate L.

Picea pungens is one of the most striking and ornamental of our exotic conifers, especially in its variety *glauca*, the light blue-green foliage of which at once arrests the attention of the observer in parks and policies where it is frequently to be met with. The species is one of the Western conifers, its native habitat being the Rocky Mountains of North America. It prefers a moist situation, but will not stand stagnant moisture, and it is not very sensitive in regard to smoke. The slightly bent quadrangular needles are seated on prominent cushions of the periderm. They are very stiff and sharply pointed. These features can be easily made out on Figs. 2 and 3. The buds are fairly large and conspicuous. The upper scales are adpressed, while the lower ones are prominently recurved. On rubbing the needles a peculiar pungent odour is set free. The prickly needles protect the tree very effectively against damage by deer and other browsing animals. They even protect the buds against the attack of squirrels. This species has as yet proved itself to be fairly hardy in Europe, being apparently free from any serious damage by insects or fungi, but unfortunately it does not appear to be entirely immune, as the following account of an apparently new fungus-enemy which has attacked it will shew :—

The fungus was found on a young individual growing among other ornamental trees in the pleasure grounds of an estate in Perthshire. This tree is shewn in Fig. 1. The branches on the lower part of the stem were more severely attacked than those

higher up, although no part of the tree was entirely free from infection. The fungus attacks the buds, and in some cases prevents their further growth. If, however, the bud is only affected on one side a slight amount of elongation may take place, but in every case the result is a twisted shoot.

An external examination shews that the buds have become encased in a dense black sheath, the surface of which is thickly dotted with spherical papillæ each with a small opening at the top (Fig. 4). The general appearance of the disease is shewn in Fig. 2, while the lower left-hand bud of this twig is given more highly magnified in Fig. 3.

Microscopical examination shews that these papillæ are the fructifications of a pyrenocarpous ascomycete. The mycelium is intercellular, and penetrates the cortex in all directions. At first, apparently, the threads are single, but finally dense wefts and strands of tough pseudo-parenchymatous tissues are formed which divide the cortex into conspicuous quadrangular areas consisting of brown collapsed cells (see Fig. 4). The hollow space in the centre of these quadrangular areas was previously filled with a mycelial pseudo-parenchyma, but this easily drops out in mounting the section, leaving a hollow circular cavity behind. To the exterior the mycelium forms a dense black stroma, the surface of which is thickly dotted with the pear-shaped fructifications of the fungus.

The pear-shaped fruit bodies (pyrenocarps) have walls consisting of small-celled dark brown pseudo-parenchymatous tissue, very dense at the outside but becoming less compact inwards. The base of the pear-shaped cavity of the pyrenocarp is occupied by a distinct hymenium of paraphyses and asci. The development of the asci seems to be successive, at least they were found in various stages of maturity in each fructification. As they become ripe they push up towards the apical pore, hence the spores appear to be liberated gradually. The number of spores in each ascus varies from 4 to 6, arranged in a uniseriate manner, and they are of a dark brown colour, and measure 20 by 6 μ. They become multi-cellular by the formation of transverse and and longitudinal septa. In outline they are torpedo-shaped with fairly sharply-pointed ends (see Fig. 5).

In material taken from the tree in the months of May and

August no asci were found, but specimens taken late in August and kept for some weeks in a moist chamber developed spores abundantly.

The fungus is one of the family of the Sphæriaceæ, and its fructification and spores seem to place it in genus *Curcurbitaria*, of which I regard it as a new species diagnosed as follows:—

Curcurbitaria piceæ, Borthwick, n. sp.

Mycelio intercellulare; peritheciis arcte gregariis, stipitatis, e stromatis effusis evolutis, nigris, carbonaceis; excipulo pseudo-parenchymatico, extus denso nigro, intus spongioso brunneo; ascis clavatis, 4-6—sporis; paraphysibus filiformibus; sporis uniseriatis, cymbiformibus, 4-10—septatis, muriatis, 20 μ longis, 6 μ latis. *Hab.* ad hibernacula Piceæ pungentis.

EXPLANATION OF THE FIGURES IN PLATE L.

Illustrating Dr. A. W. Borthwick's Paper "A New Disease of Picea."

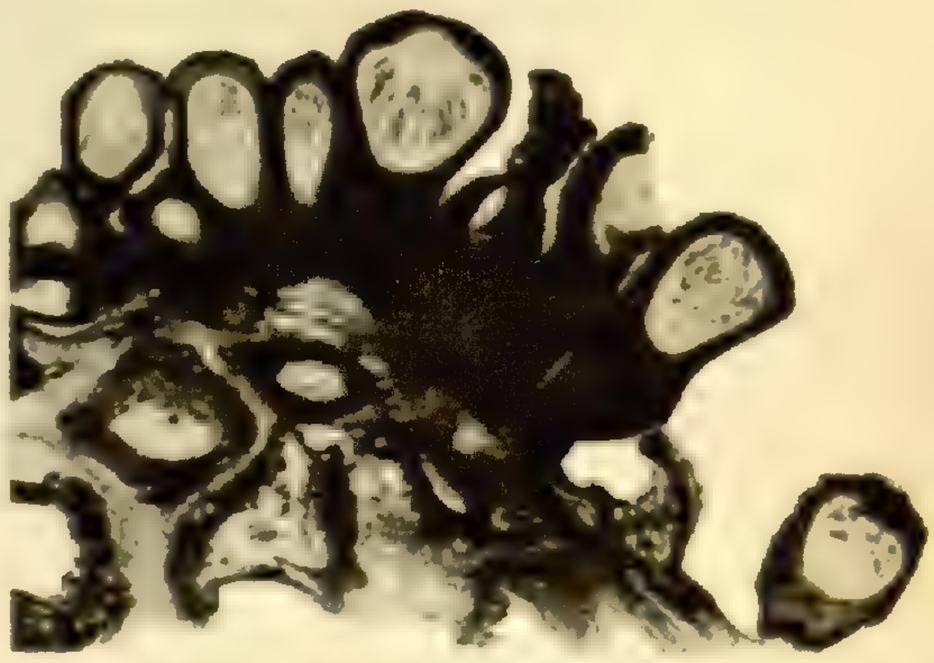
FIG. 1. Picea pungens; the tree on which the disease was found. The lower branches have been more severely attacked than the higher ones.

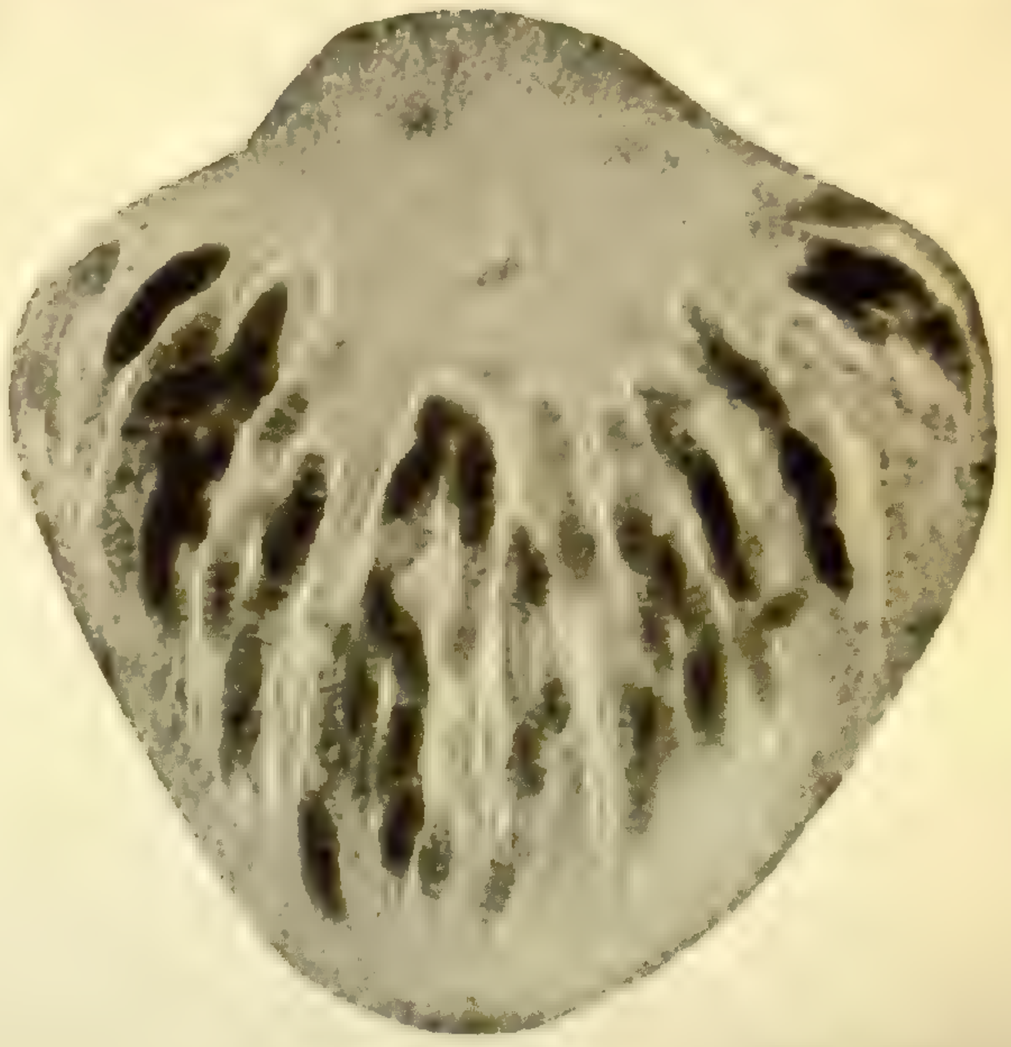
FIG. 2. Twig with buds covered by the stroma and pyrenocarps of the fungus.

FIG. 3. Lower left-hand bud of Fig. 2 more highly magnified, shewing the ostioles at the apex of the pyrenocarps.

FIG. 4. Section across an attacked bud shewing the intercellular strands of hyphæ, the quadrangular patches of brown, collapsed cortical cells with hollow spaces in the middle, and the black stroma and pyrenocarps on the outside

FIG. 5. Asci of central pyrenocarp of Fig. 4 more highly magnified.





Huth, coll.

Frost Canker of Picea sitchensis (Trautv. et Mey.), the Menzies Spruce.

BY

A. W. BORTHWICK, D.Sc.,

LECTURER ON FOREST BOTANY IN THE UNIVERSITY OF EDINBURGH.

With Plate LI.

The Menzies spruce was introduced in 1831 by Douglas, and as a timber tree it was a very valuable addition to our forest flora. It is one of the many conifers introduced from Western North America. In horizontal distribution it ranges between Northern California and Alaska, and is especially abundant on the island of Sitka. In vertical distribution it ascends to an altitude of 7000 feet in the Rocky Mountains.

Authorities both in this country and on the Continent agree that the Menzies spruce is an exotic conifer which has proved itself to be well worthy of cultivation as a forest tree for profit. Dr. Nisbet states that—"With the sole exception of the larch, this tree and the Douglas fir (but especially the latter) are probably the most important coniferous timber trees that have ever been introduced into Britain. They are certainly the most important introduced from North America at any time, and the most important trees introduced into Britain during the nineteenth century."[1]

At the beginning of October of 1908 I received a number of specimens of diseased Menzies spruce from an estate in Ayrshire. My correspondent, in his letter, says:—"The trees were planted about three years ago in order to fill up the vacancies in a fifteen-year-old plantation of Scots pine, larch, and spruce. I was particularly struck by their fine appearance last year, and was very pleased to think the soil would be completely covered in a year or two, but in the early part of last summer I was much disappointed to find about two-thirds either dead or dying. The severe frost we experienced in the

[1] The Forester, 1905, Vol. I., p. 242.

[Notes, R.B.G., Edin., No. XX, March 1909.]

middle of April may have been the primary cause, but there is little doubt something more serious is at work now." I have seen since these plantations, and can vouch for my correspondent's statement that at least two-thirds of the plants are infected; I should say more, in fact, in the plantations shown to me I was unable to find a single perfectly healthy specimen.

In the month following (November) I received from another estate, this time in Argyllshire, a consignment of Menzies spruce similarly affected. My correspondent here also gives a similar account. He says:—" There is apparently a fungus, but possibly the trees are predisposed to attack by frost. I have planted this tree rather extensively, as it grows fast here, often three or more feet in a season. This disease has been noticed for the last two or three years, but only on a very small scale. This year, however, thousands of trees are affected in all situations and varieties of soil, though it is worst in the hollows and least in airy situations. In nearly all cases the second year's wood is affected, and all above that dies off. The lower part of the tree remains vigorous and fresh looking, and quickly throws a new leader or leaders. This year we had a severe frost, 10 to 15 degrees, on two nights in May."

Since then still another inquiry, accompanied with specimens showing identical symptoms, has come in to me from Perthshire.

Evidently there has been widespread damage to the Menzies spruce. In all cases the young trees after a period of very promising growth suddenly collapsed. The first sympton of attack is apparently a striking change in the colour of the foliage, which loses its dark green and becomes pale yellow. Next, the leader loses its leaves and usually turns dark red in colour, and its side buds, or branches, are arrested in their growth. The needles are usually retained on the older parts, and if the tree is not killed outright an attempt to replace the leader by a side branch is made. Figure 1, Plate li., shows this condition of affairs. The end of the leader was, however, cut off for convenience in transport before the specimen was sent to me. The tip was, however, in the same state as the basal portion. The stem in many cases was found to be cankered. The first indication of this is a slight flattening at one or two points accompanied by an outflow of thin bluish-white resin which makes conspicuous the cankered spots. Later the bark splits, exposing the wood, and an attempt is made by the tree to cover these exposed areas by

a callus formation. Figure 1 shows a cankered portion with the split bark on a three-year-old stem. Figures 3 and 4 show a characteristically cankered stem from both sides. The plastic material coming from the whorl branches nourishes the living tissues and stimulates callus formation where splitting has taken place, and this results in the swollen portions (very well seen in Figure 4) at the base of the living branches.

An anatomical examination of the tissues leaves little doubt that frost is the primary cause. Dead branches were only found on trees which showed canker, and the canker seems to occur invariably lower down on the tree where the parts are two or more years old.

The fructifications of an ascomycetous fungus are invariably present, and this may have something to do with the malady, but it will require further investigation to settle this point. The appearance of the fungus fructifications dotted over the surface of the stem above the whorl of branches is seen in Figure 2.

Apparently other conifers have been attacked in a similar way. Early in October Mr. Leven, head forester to Mr. Oswald of Auchincruive, Ayrshire, and a former member of the staff of the Royal Botanic Garden, sent a branch of Douglas fir which shows the fructifications (apothecia) of an ascomycete apparently similar in every way to those on the Menzies spruce and, as will be seen from the photograph of this specimen, Figure 5, the splitting of the stem with the subsequent callus formation agrees exactly with what takes place in the Menzies spruce.

Quite recently I have seen in Perthshire many young Douglas firs, and also a specimen of Abies nobilis, which showed identical symptoms to those above described.

EXPLANATION OF THE FIGURES IN PLATE LI.

Illustrating Dr. Borthwick's paper on "Frost Canker of Picea sitchensis, the Menzies Spruce."

FIG. 1. Apical portion of young Menzies spruce, showing the dead leader replaced by side branch, and also, below it, the cankered portion of stem.

FIG. 2. Portion of stem showing the fructifications of an ascomycetous fungus.

FIG. 3. Portion of a cankered stem showing splits in bark with subsequent callus formation and swellings below the branch whorls.

FIG. 4. The same specimen as in Fig. 3, but seen from the opposite side.

FIG. 5. Branch of Douglas fir, showing symptoms similar to those in Menzies spruce.

1.

3.

4.

2.

5.

Borthwick — Frost-canker of Picea sitchensis, Trautv. et Mey.

Abnormal Branch of Prunus Avium.

BY

A. W. BORTHWICK, D.Sc.,

LECTURER ON FOREST BOTANY IN THE UNIVERSITY OF EDINBURGH.

With Plate LII.

Witches' Brooms are of fairly common occurrence in our woodlands, parks, and policies. Their twiggy, compact crow's nest-like appearance readily attracts attention. They cannot by any means be called ornamental, and in the majority of cases their presence disfigures the natural beauty of the tree.

These abnormal growths are caused by various agencies. Often they are due to the attack of a fungus or an insect. The irritation set up by the invading organism at the point of attack stimulates the tissues in the immediate vicinity to very rapid and abnormal development, which results in formation of the hypertrophies called Witches' Broom In many cases the exact nature and cause of the malady has been definitely ascertained, but there still remain a good many "Brooms" about which practically nothing is known. In fact, the list of woody plants which bear Witches' Broom appears as yet to be anything but complete. This list has, however, been considerably added to within recent years as the result of an article by Professor Tubeuf,[1] in which he pointed out that nothing was known as to the nature or cause of Witches' Broom which he had observed on the following species—beech, spruce, Scots pine, Weymouth pine, larch, elm, silver fir (a different one from that caused by Æcidium elatinum), Robinia, Prunus spinosa, poplar, and others.

[1] Tubeuf in Naturwissenschaftliche Zeitschrift fur Land und Forstwirtschaft, July 1904, p. 295.

[Notes, R.B.G., Edin., No. XX, March 1909.]

He appealed to forest officers to send him twigs from any of these brooms which might come under their observation, in order that further investigations might be made.

Professor Solereder[1] soon after gave an account of a Withes' Broom on *Quercus rubra L.*, although he was unable to determine the cause, and in additon to this he took the great trouble of going through the literature on Witches' Brooms, and gives us at the end of his article a list of all "Brooms" known to occur on woody plants and at the same time references to the more important literature concerning them, and so far as known the cause of each. This list was a most welcome and very important addition to the literature on the subject. Since then several additions have been made to this list, and no doubt more will follow.

Following upon the request by Tubeuf for information, Franz Muth[2] took up the investigation of broomed pear trees growing in the forest above Oppenheim on the right bank of the Rhine. He found very evident fungus mycelium in the wood of the attacked branches, but as no fructifications could be got it was not possible to determine the species. With his article Muth gives photographs of a peculiar and abnormal branch development on a pear tree near Durlach in Baden. The tree bears a thickly branched upright bush supported on a branch almost as thick as the main stem of the tree. The cause of this abnormal branch development is attributed by Muth to a rind disease caused apparently by a fungus. Although he does not call this a Witches' Broom, still it evidently belongs to the same category of diseases.

Muth's observations are interesting in relation to what appears to be a similar phenomenon which is shown in the abnormal branch growth of the specimen illustrated in Plate lii. This tree is, however, Prunus avium, and is growing in the policies of an estate in Midlothian. A side branch seems to have been attacked and has developed to extraordinary dimensions, forming as it were a secondary bole on the tree. On the shoot-system belonging to this secondary bole several smaller, but

[1] Solereder in Naturwissenschaftliche Zeitschrift fur Land und Forstwirtschaft, January 1905, p. 17.

[2] Muth in Naturwissenschaftliche Zeitschrift fur Land und Forstwirtschaft. Über den Birnenhexenbesen, February 1905, p. 64.

what seem to be independent Witches' Brooms, are present. These smaller brooms also occur on other parts of the tree.

The main trunk is 5 feet 1 inch in girth at 5 feet from its base. The abnormal branch bearing the brooms comes off at 8 feet 6 inches above the ground. Beyond the spherical swelling at its base is visible the attenuated apical portion of the present branch.

Borthwick—Abnormal Branch of Prunus Avium.